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314/82

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EFFECT OF ETHYLMETHANESULPHONATE IN M_1 POPULATION OF *DALBERGIA SISSOO* ROXB.

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Introduction

Induced mutagenesis has played a great role in the improvement of crop plants. It is only recently that the tree breeders are paying attention to this field. Gustaffson (1960) and Heslot (1965 reviewed the work on chemical mutagenesis in higher plants and summarised the various chemicals that have been tried. According to Gustaffson (1960) ethylmethanesulphonate is a very potent mutagen because it induces mutation rates higher than those ever obtained with physical mutagens in some plant species. According to Konzak *et al.* (1965) the potency of any mutagen is dependent on its mutagenic efficiency and effectiveness, EMS has been found to possess both these qualities However, very few workers have tested the effect of chemical mutagens on forest tree species. The main contributors in this field are Yim (1963), Hanover (1965), Hanover and Hoff (1966), Vaarama (1969), Samoshkin (1972, 1973, 1975, 1978), Shchepotev and Sumskaya (1977), Samoshkin and Ivanov (1978) and Terasmaa (1977, 1978, 1979). Again most of these studies have been confined mainly to *Pinus* sp. and a few other gymnospermous species but very few reports are available on angiespermous species. However, *Dalbergia sissoo* has not been used so far as experimental material to study the effect of physical and chemical mutagens except at this laboratory. In our laboratory work on chemical mutagenesis was started after 1965. Seeds of *D. sissoo* were treated with different concentrations of EMS in the year 1966 to study its sensitivity to the mutagen and as well as evolving techniques for inducing beneficial mutations. Some of these EMS treated seedlings raised after seed treatment including the untreated controls were planted in the field to study the effect of EMS on meiosis, pollen grain fertility, pod characters, pod fertility and seed viability in M_1 population and later to raise M_2 generation to study the segregation pattern and select mutants if any. Results on M_1 trees of *D. sissoo*, which is one of the best timber species in Indian subcontinent are reported in this communication.

Materials and methods

A few trees available in M_1 population raised from seeds treated with different concentrations of EMS as well as untreated controls were randomly selected and observations were recorded on the following parameters :

Pod characters. Twenty five pods from each tree were taken at random to study four different parameters namely length of pedicel, length of pod, width of pod and number of seeds per pod. The data collected were subjected to analysis of variance (ANOVA) to see the significances of differences observed in between different doses and control.

Seed germination. Seeds were kept for germination from each tree of the different treatment in petridishes having moist filter paper. Petridishes were maintained at $30\pm5°C$ temperature in the laboratory.

Meiosis. Flower buds were fixed in 1 : 3 Acetic-alcohol between 10–30 to 11–00 A.M. during March, 1981 and kept for 24 hours at room temperature in the fixative. They were stored in 70% alcohol in the refrigerator before squashing. Anthers were smeared with 2% Acetocarmine solution and pollen mother cells were scored for abnormalities at anaphase. At least 50 or more cells were studied per tree per treatment. Also, where available the number and behaviour of bivalents in diakinesis and metaphase I stage of meiosis were studied.

Pollen fertility. Pollen grains extracted from well–blossomed flowers were stained with 1% acetocarmine solution and their fertility was determined on the basis of stainability. Stained pollen grains were considered as viable and empty unstained grains were considered as sterile.

Results and discussion

There was no significant amount of abnormalities in meiotic chromosomes of the treated trees. Metaphase I as well as Diakinesis showed always 10 bivalent formation (Fig. 1). No variation in the number and behaviour of bivalents as well as chromosome separation in Anaphase I were seen, except a very few pollen mother cells which showed the formation of laggards and bridges in Anaphase I separations (Figs. 2-4). In Anaphase II also some lagging chromosomes were seen (Table 1). From the table it could be seen that there was no significant differences in chromosomal abnormalities between the trees of the same treatment or between the different treatments. Thus, it would appear that EMS did not produce severe effects on meiotic behaviour of *D. sissoo* in M_1 population. In crop plants there are conflicting reports about the chromosomal aberrations produced by EMS treatment at M_1. Swaminathan *et al.* (1962) reported high meiotic abnormalities in EMS treated barley and wheat, while Rao (1977) working on EMS treated rice found no chromosomal abnormalities in meiosis although it was high in gamma ray treated rice plants. As regards forest trees such data showing the effect of EMS on meiosis are not available.

Table 1

Effect of EMS on meiosis and seed germination of D. sissoo

EMS Concentration	Total number of cells observed	Mean percentage of abnormal cells	Mean percentage of fertile pollen grains	Mean percentage of seed germination (M_2)
Control	150	0.0	98.00	90.00
0.15%	235	2.58	94.00	60.00
0.30%	215	3.43	96.30	42.20
0.45%	168	4.60	96.20	39.60

Studies on pollen grain fertility also showed no significant sterility. Almost all the trees had above 90% fertile pollen grains based on stainability (Figs. 5–6). This was expected also as the percentage of chromosomal aberration was very low scored at anaphase in meiosis. This will show that the doses of EMS tried were quite tolerable to *D. sissoo*.

Table 2

Effect of EMS on pod characters of D. sissoo

Character	Treatments			
	Control	0.15% EMS	0.30% EMS	0.45% EMS
Mean length of pod (cm)	4.46	4.89	4.45	4.41
Mean width of pod (cm)	0.84	0.79	0.84	0.72
Mean length of pedicel (cm)	0.77	0.89	0.87	0.85
Mean number of seeds per pod	1.39	1.39	1.27	1.38

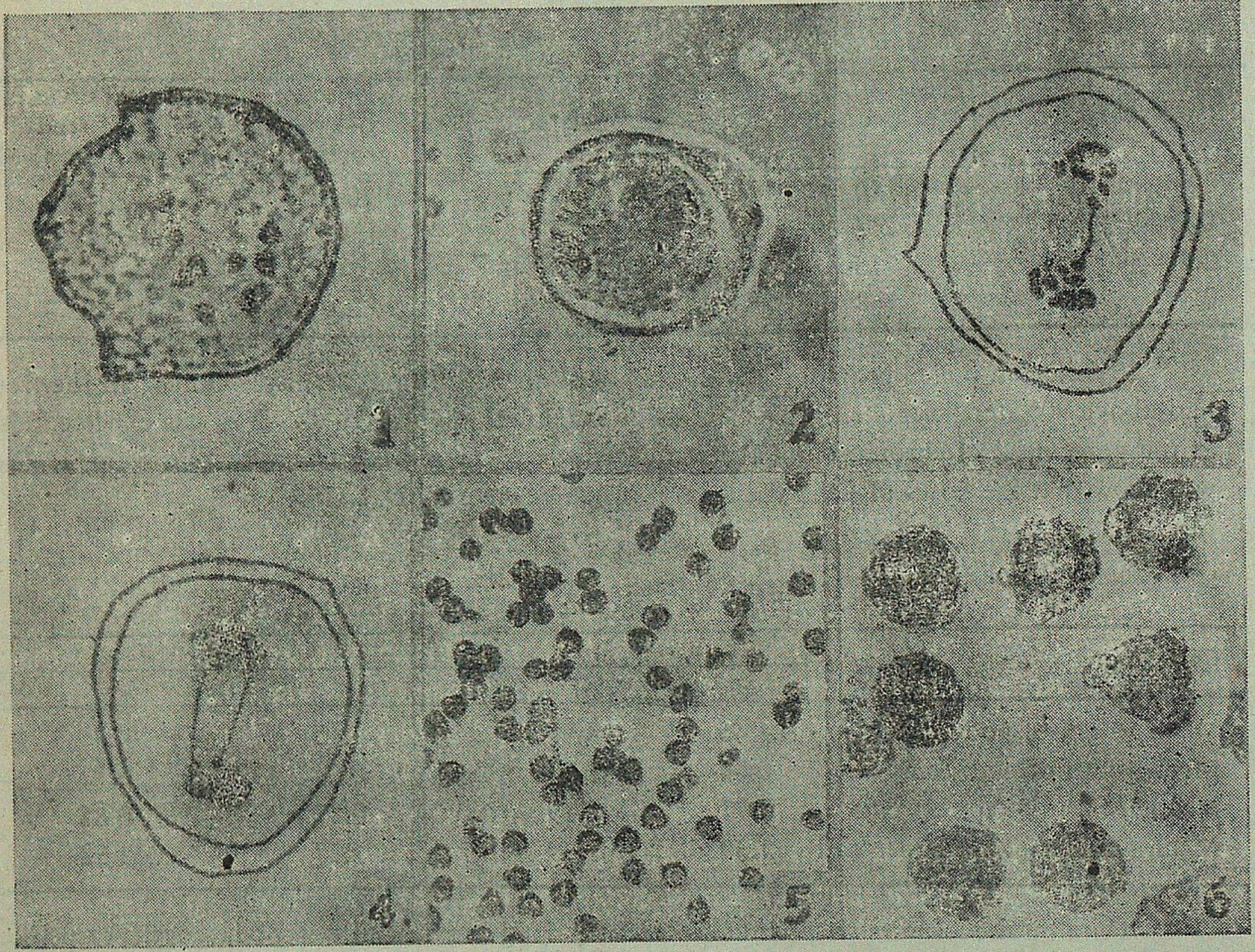
Data on the studies on pod characters e.g. length and width of pod, length of pedicel and number of seeds per pod were subjected to ANOVA. The differences between the trees as well as between the treatments were found non-significant(Table 3). No sterile pod was found, although the number of seeds from pod to pod varied. Moreover, some doses had stimulatory effect on the growth of some characters viz length of pod, length of pedicel. Such stimulatory effects have also been reported by different workers using several chemical mutagens (Samoshkin 1972, 1975; Samoshkin and Rodyanov 1973).

Table 3

ANOVA for four different pod characters in D. sissoo raised after treating seeds with EMS

Source of Variation	df	Mean sum of squares			
		Length of pod	Width of pod	Length of pedicel	No. of seeds per pod
Between trees	2	0.0222 N.S.	0.0003 N.S.	0.0006 N.S.	0.0209 N.S.
Between treatments	3	0.1545 N.S.	0.0091 N.S.	0.0079 N.S.	0.0101 N.S.
Error	6	0.0762	0.0048	0.0230	0.0102

N.S. : Not significant



Figures 1 to 6 : Chromosomes and pollen grains of *Dalbergia sissoo.*

Fig. 1—Metaphase I showing 10 uniform bivalents (× 1000).

Fig. 2—Normal anaphase I showing equal separation of chromosomes (× 1000).

Fig. 3—Anaphase I with a chromatid bridge (× 1000).

Fig. 4—Anaphase I with two chromatid bridges (× 1000).

Fig. 5—Pollen grains showing high fertility (× 100).

Fig 6—Pollen grains as seen in high magnification (× 400).

Germination of M_2 seeds showed a decreasing trend with the increasing dosases of EMS. More than 50 per cent reduction in germination was observed in 0.30 and 0.45 per cent concentration over the untreated controls. However, 33 per cent reduction was observed at 0.15 per cent concentration over the control. Thus, it would appear that based on germination for mutation studies 0.15 per cent concentration seems to be more appropriate.

Studies with EMS in *D. sissoo* (Kedharnath et al , 1970) showed that *D. sissoo* was more sensitive to EMS than *Pinus roxburghii,* a gymnospermous species where 50% reduction in comparison to control was observed at 0.60% concentration taking germination into account.

However, for the present studies the **surviving trees** were available only in the concentrations, .15%, .30% and .45% of EMS respectively. It would suggest that *D. sissoo* could tolerate EMS upto 0.45% concentration without showing adverse effects on meiosis pollen, germination of seed, pod characters or even survival. *D. sissoo* is one of the most important timber species, it has got a drawback in having crooked stems, therefore, M_2 population will be raised for screening mutants for straight stem forms to bring genetic improvement.

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SUMMARY

The effect of Ethylmethanesulphonate (EMS) was studied in M_1 trees of *Dalbergia sissoo* raised after seed treatment. Parameters like pollen fertility, pod characters, seed germination and chromosomal abnormalities were scored at anaphase of meiosis. Pollen fertility in all the trees emanating from different treatments was above 90 per cent. Though, slight differences due to treatment in respect of length and width of pod, length of pedicel and number of seeds per pod were observed, they were found to be statistically non-significant. Decrease in germination percentage of M_2 seeds in higher doses was observed. Stimulatory effect in some characters was also observed.

डलबर्गिया सिस्सु राक्सब० के एम$_1$ वृक्षों पर इथाइलमीथेनसल्फोनेट का प्रभाव

लेखक एम०एस० हक, एम०एल० कपूर व वी०के० शर्मा

सारांश

उपचार किए बीजों से उगाए हुए एम$_1$ डलबर्गिया सिस्सु वृक्षों पर इथाइलमीथेनसल्फोनेट (इमीस) के प्रभाव का अध्ययन किया गया। पराग उर्वरता, फली के लक्षण, बीज अंकुरण और गुणासूत्र असामान्यताएं जैसे परिमापों को भाजनोत्तर अर्धसूत्रणा पर निकाला गया। विभिन्न उपचारों वाले बीजों से होने सभी वृक्षों में पराग उर्वरता 90 प्रतिशत से अधिक रही। यद्यपि विभिन्न उपचारों के कारण फली की लम्बाई और चौड़ाई, वृत्त की लम्बाई और फली में बीजों की संख्या में मामूली अन्तर लक्षित किया गया, ये अन्तर सांख्यिकीत: असार्थक रहे। अधिक मात्रा बढ़ाने पर एम$_2$ बीजों के अंकुरण प्रतिशत में कमी होती देखी गई। कुछ लक्षणों में प्रेरक प्रभाव भी होटे पाए गये।

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ASSESSMENT OF WEEDICIDES AND NITROGEN ON RANGE GRASSLAND PRODUCTIVITY

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Introduction

Nearly one-third of the natural grasslands area in India are infested with unproductive bush species. These species have a prolific capacity of natural regeneration from coppice unless each bush is dug out from roots. Besides bush, many annual dicot weeds naturally occur in grasslands—they may affect the yield and the quality of forage produced. The importance of weed control in pastures has been discussed by Dutta and Singh (1970) and Ganguli (1964). The recommended methods for high production in natural grasslands envisage the eradication of bush and other weed species, application of nitrogenous fertilisers, controlled grazing and moisture conservation measures. The present study deals with the use of herbicides and nitrogenous fertiliser in natural grassland to promote forage production.

Details of the study

The experiment was carried out in a natural bush infested grassland area at Jhansi on two different sites of red gravelly soil in 1970 and 1971. The grass flora was largely dominated by *Heteropogon contortus*. The treatments included :

1. No treatment—control (C)
2. Foliar application of 2, 4–D (2, 4–dichlorophenoxy acetic acid) @ 1 kg a.i./ha (D)
3. Foliar application of atrazine (2–chloro–4–ethylamino–6–isopropylamino–1, 3, 5–triazine) @ 1 kg a.i./ha (A)
4. Broadcast application of Tordon 10 K pellets (Picloram=4 amino–3, 5, 6 –trichloropicolinic acid) @ 30 kg/ha (T_1)
5. Broadcast application of Tordon 10 K pellets @ 30 kg/ha (T_2)
6. Treatments No. 4 + 2 (T_1D)
7. Treatments No. 4 + 3 (T_1A)

These seven treatments were combined with two levels of nitrogen (top dressed as calcium–ammonium–nitrate granules) viz. no nitrogen (F_0) and 50 kg nitrogen/ha (F_1). Likewise, 14 treatment–combinations were employed in randomized block design with three replicated plots, each 6 m² (gross). Buffer strips with more than one m width were provided

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between plots and each plot was demarkated by preparing earthen boundry around it Net plot consisted of 5 m^2. Foliar spray of 2, 4-D and atrazine each diluted in 600 litre water/ha were applied as blanket spray in the month of July (sparing bush species) when broadleaf weeds were 10–15 cm tall. Tordon 10 K pellets alone or mixed with calcium-ammonium-nitrate were also broadcast in July when the soil was moist (at the onset of *monsoon*) for the absorption of applied herbicides. At this stage, the productive grasses (predominantly *H. contortus*) and the existing woody species were growing actively.

Population of annual broadleaved weeds were recorded with three randomly placed 50 cm^2 quadrats in each plot. Intensity of bushes and the ground cover were recorded plotwise at (July) and after (October) the application of treatments. At final bush observation, dead woods from Tordon treated plots were cut and removed. In October, grass was harvested and weighed.

Observations

Bushes. Lignaceous weed species were *Zizyphus nummularia, Carissa spinarum, Securinega virosa, Flacourtia indica, Butea monosperma, Zizyphus xylopyrus, Lantana camara* and *Mimosa himalayana.* During the second year, *Acacia leucophloea* was encountered occasionally while *Flacourtia indica* was missing from the experimental area.

Bush intensity. Tordon 10 K pellets in the range of 15–30 kg/ha appeared effective for controlling existing woody weeds save semiarboreal species e.g. *B. monosperma, A. leucophloea* and *F. indica.* The older bushes of *S. virosa, Z. xylopyrus, Z. nummularia* and *C. spinarum* were partially affected showing merely defoliation effects. Tordon 10 K pellets @ 30 kg/ha caused quicker mortality of susceptible bush species and higher degree defoliation in older bushes. During second year, higher dose (T_2) appeared better than the lower one (T_1) but in first year, exceptionally, less number of bushes was recorded with lower dose (T_1) as compared to higher dose (T_2) of Tordon 10 K pellets (Table 1). This might be due to the uneven distribution of bushes resulting in the intensity with greater proportion of the older woody weed speci s resistant to the higher rate of tordon. This might be the probable reason for the variable performance of even similar treatment in two different years. However, Fig. 1 shows that Tordon 10 K pellets @ 15 and 30 kg/ha, reduced bush intensity by 71% to 75%.

Bush infested area. In the control plot (C) bushes occupied 19.2% and 29.2% area of grassland which rose upto 23.2% and 68 0% during first and second years respectively during *monsoon* season. On two years average basis, bush infested area under control increased by 77% in *monsoon* season. Tordon K pellets by killing the existing growth and preventing further proliferation of bushes, released grassland area considerably for grass growth. This herbicide @ 30 kg/ha (T_1) was slightly better than its lower dose (T_1) (Table 1) and the effect of which ranged from 56 (T_1) to 59 (T_2) per cent (mean of two years) (Fig. 1).

Annual broadleaf weeds. The chief weeds were *Borreria stricta, Indigefera linaci, Heylandia latibrosa* and *Tridax procumbens.* Weed intensity was more pronounced in the first year as compared to the final year. Herbicidal treatments eliminated the broadleaf weeds drastical y.

Table 1

Effects of weed control treatments on weed infestation

Treatments		Intensity of bushes/ha			Bush infested area/ha (M^2)			No. of broadleaf weeds/m^2		
		Pre-treatment	Post-treatment	% reduction over pre-treatment	Pre-treatment	Post-treatment	% increase (+) or decrease (—) over pre-treatment	Pre-treatment	Post-treatment	% control over pre-treatment
1. No. weeding (C)	1970	2260	2260	—	1922	2322	+ 21	45	214	—
	1971	7600	7600	—	2920	6800	+ 133	48	64	—
2. 2,4-D @ 1.0 kg/ha (D)	1970	2200	2200	—	1302	1952	+ 50	63	12	81
	1971	3200	3200	—	1960	3000	+ 53	44	7	84
3. Atrazine @ 1.0 kg/ha (A)	1970	720	720	—	1632	2166	+ 33	57	19	67
	1971	2400	2400	—	4040	5440	+ 35	50	2	96
4. Tordon 10 K Pellets @ 15 kg/ha (T_1)	1970	1260	60	95	2010	918	— 54	43	5	88
	1971	2800	1280	54	3840	1640	— 57	43	4	91
5. Tordon 10 K Pellets @ 30 kg/ha (T_2)	1970	1840	920	50	2524	1326	— 47	75	0	100
	1971	5600	480	91	3840	1160	— 70	45	4	91
6. Treatment No. 4+2 (T_1D)	1970	860	320	63	1474	414	— 72	44	0	100
	1971	3600	600	83	2840	1100	— 61	49	2	96
7. Treatment No. 4+3 (T_2A)	1970	1660	1320	20	3264	1164	— 69	86	1	99
	1971	4400	520	90	3560	1120	— 69	50	6	88

Note :- While recording broadleaf weeds, the plants below 2–5 cm height were note counted.

Pooled results of the two years showed that Tordon 10 K pellets @ 30 kg/ha (T_2) singly and 15 kg/ha (T_1) in combination with 2, 4–D (D) reduced weeds by 96% and 98% respectively (Table 1).

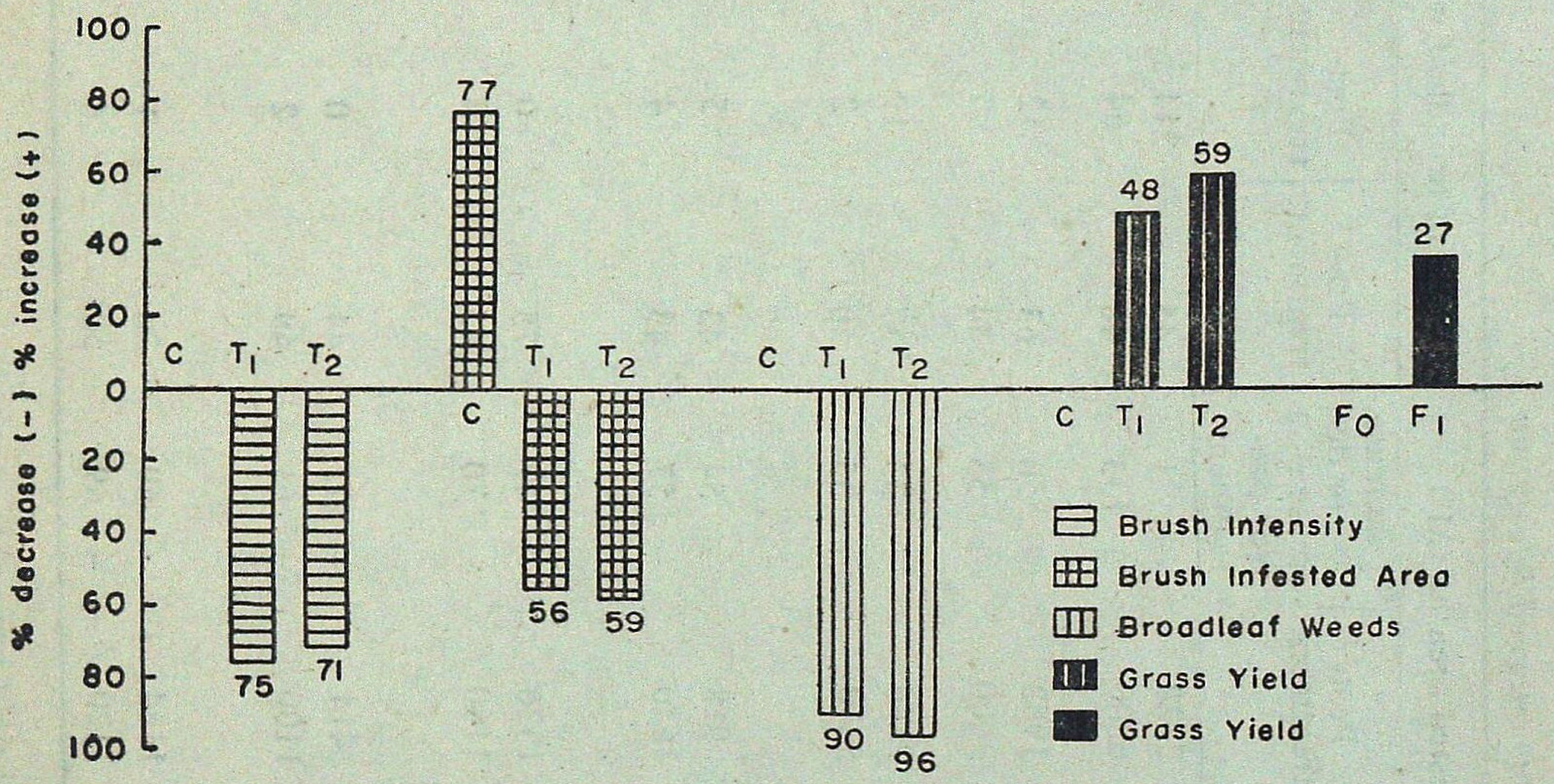

Fig. I Picloram effects on weed infestation and grass yield

Effects on grass yield. Plots treated with Tordon 10 K pellets @ 15 (T_1) ane 30 (T_2) kg/ha consistently showed higher grass yield in both consecutive years and appeared significantly better than no weeding treatment (C). This chemical at 30 kg/ha (T_2) raised grass production by 69% and 49% in first and second year respectively. On the basis of two years mean, this treatment showed maximum increase of 59% in the production potentiality of grass (Fig. 1). The differences between low and high rates (T_1 and T_2) were not significant. Combined application of Tordon 10 K pellets (T_1) with 2, 4–D or atrazine (T1 D and T1 A) did not promote grass yield significantly over the aforesaid promising treatment (T_2). Foliar application of 2, 4–D or atrazine singly did not contribute to the grass yield substantially.

Top dressing of calcium ammonium nitrate (50 kg N/ha, promoted the production of *H. contortus* significantly over no N (F_0) and raised grass yield from 63.8 (F_0) to 81.8 q/ha showing 27% (mean) increase (Fig. 1).

Discussion of results

It was obvious from the results that Tordon 10 K pellets was effective against both bushes and broadleaf weeds. The partial or negative effect on arborescent species might be due to their better root establishment and older growth as compared to the affected species.

The younger bushes of the same species showed susceptibility. Dutta and Pandey (1971) found *B. monosperma, A. leucophloea* and *A. catechu* resistant even at higher dose application of Tordon 10 K pellets. Improvement in the grass yield may be attributed to the prolific growth and better harvest of grass due to release of space under controlled bushes and broadleaf condition. This increase in yield might also be attributed to the addition of organic matter due to leaf fall from the affected bushes. Swezey and Montano (1968) reported 3 and 7 fold increase in the yield of desirable grass in Panama in 100 days and 15 months, respectively after picloram treatment. The treatment was found non-injurious to established grass crop. This is in conformity with the findings of Derschied (1966), Guazzeli and Rios (1969) and Dutta and Pandey (1971). Lynn (1965) also reported picloram as formulated under the brand name Tordon safe for animals. The control of broadleaf weeds only brought an increasing trend in forage yield but to an insignificant extent which was quite clear from the contribution of 2,4-D or atrazine treatment applied merely for the control of broadleaf weeds. Since picloram was effective against both bushes and annual dicot weeds simultaneously, the foliar treatments of 2, 4-D and atrazine were not useful to enhance its efficiency under combined treatments. The application cost of Tordon reduced by combining the operation with nitrogen application. Grass response to N is confirmed by the findings of Shankarnarayan *et al.* (1973) and Bhaid and Bahl (1970).

Table 2

Effects of treatments on yield of Heteropogon contortus

Treatment	Yeild (q/ha)			% increase over control		
	1971	1970	Mean	1970	1971	Mean
1. No weeding (C)	58.40	55.20	56.80	—	—	—
2. 2, 4-D @ 1.0 kg/ha (D)	61.60	60.40	61.00	6	9	8
3. Atrazine @ 1.0 kg/ha (A)	62.40	63.60	63.00	6	15	11
4. Tordon 10 K pellets @ 15 kg/ha (T_1)	96.00	71.60	83.80	64	31	48
5. Tordon 10 K pellets @ 30 kg/ha (T_2)	98.80	82.40	90.60	69	49	59
6. Treatment 4+2 (T_1D)	64.80	74.40	69.60	9	35	22
7. Treatment 4+3 (T_1A)	82.00	89.20	85.60	40	62	51
S. Em ±	7.20	4.40	—	—	—	—
C.D. at 5%	20.80	12.76	—	—	—	—
C.D. at 1%	28.40	17.24	—	—	—	—
No Nitrogen (F_0)	66.00	61.60	63.80	—	—	—
50 kg " (F_1)	83.60	80.00	81.80	25	29	27
S. Em ±	3.60	2.40	—	—	—	—
C D. at 5%	10.40	6.96	—	—	—	—
C D. at 1%	1400	9.40	—	—	—	—

Conclusion

Tordon 10 K pellets @ 15 to 30 kg/ha was effective for controlling younger bush species and associated broadleaf weeds in the natural grasslands of *H. contortus*. The treatment became more attractive and economical by its combination with the normal practice of nitrogen application. The problem of occasional arborescent bushes like *B. monosperma, A. leucophloea* and *A. catechu* etc. may be overcome by judicious application of 2, 4, 5-T on stump (Pandey and Singh, 1969) or girdle treatment with Tordon 101 mixture (Dutta and Pandey, 1971). On regeneration of bushes, the follow up action may be taken to control them by spot treatments. Tordon run off from the treated area may also be avoided.

Acknowledgement

The authors are thankful to the Director, Indian Grassland & Fodder Research Institute, Jhansi for facilities provided for the investigation.

SUMMARY

Field experiments were conducted at Jhansi in 1970-71 for the control of bush and broadleaf weeds in natural grasslands dominated by spear grass *(H. contortus)*. Picloram (Tordon 10 K pellets), 2, 4-D amine and atrazine with nitrogen application were tried. Tordon 10 K pellets @ 15-30 kg/ha applied as broadcast killed *Z. nummularia, M. himalayana, L. camara, C. spinarum, S virosa* and *Z. xylopyrus* in *monsoon* season. The older and semi-arborescent plants of *Z. nummularia, C. spinarum, S. virosa, Z. xylopyrus* escaped kill showing merely defoliation with greater degree at higher dose. *B. monosperma, A. leucophloea* and *F. indica* did not respond to Picloram pellets. This herbicide also caused excellent control of existing broadleaf weeds. On the basis of pooled data of two years trial, Tordon 10 K pellets at 30 kg/ha appeared slightly more efficient over 15 kg which promoted grass yield by 59%. Top dressing of 50 kg N/ha as calcium-ammonium-nitrate (pellets) significantly elevated grass production over no nitrogen and saved application cost of Tordon in combined application.

गोचर घासभूमियों की उत्पादकता पर तृणनाशियों और नाइट्रोजन के प्रभाव का आकलन

लेखक आर०के० पाण्डेय, टी०आर० दत्त, आर०पी० सिह व एस०डी० गुप्त

सारांश

प्राकृतिक घासभूमियों में, जिनमें सामान्य कुंत घास (हि० कंटोर्टस) का प्राबल्य था, झाड़ियों और चौड़े पत्तों वाले तृणकों के नियंत्रण के लिए 1970–71 में झांसी में कुछ क्षेत्र संपरीक्षण किये गये। इसके लिए पिक्लोराम (टारडन 10 के गोलियां), 2, 4-डी एमिने और नाइट्रोजन युक्त एट्राजीन उपयोग करने का परीक्षण किया गया। टारडन 10 के गोलियां 15-30 कि०/हेक्टे० की दर से छिड़काव करने पर जि० नुम्मुलेरिया, एम० हिमालयाना, ले० केमारा, कै० स्पाइनेरम, एस० वाइरोसा और जि० जायलोपायरस मानसून मौसम में मर गए। जि० नुम्मुलेरिया, कै० स्पाइनेरम, एस० वाइरोसा, जि० जायलोपायरस के अधिक उम्र के और अर्द्ध वृक्षवत पौधे मरने से बच गए और अधिक मात्रा देने पर अधिक मात्रा में उनकी पत्तियां ही झड़ी। ब्यू० मोनोस्पर्मा, अ० ल्यूकोलिफ्लआ और फा० इण्डिका पर पिक्लोराम गोलिकाओं का प्रतिचार नहीं हुआ। इस शाकनाशी ने जंगल के चौड़े पत्तों वाले तृणकों पर भी अत्युत्तम नियन्त्रण किया। दो वर्ष तक एकत्रित किए गए इस परीक्षण

के आंकड़ों के अनुसार 15 किलो० के मुकाबले 30 किग्रा०/हेक्टे० की दर से टारडन 10 के गोलिकाएं उपयोग करना मामूली-सा अधिक अच्छा रहा जिससे घास प्राप्ति भी 59 प्रतिशत अधिक मिली। कैलसियम-एमोनियम-नाइट्रेड (गोलियों) के रूप में 50 किग्रा० नाइट्रोजन/हेक्टे० ऊपर डलवाने ने नाइट्रोजन न देने के मुकाबले में घास उत्पत्ति में सार्थक वृद्धि की ओर इसे साथ मिलाकर देने पर टारडन उपयोग करने की लागत में कमी हुई।

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GROWTH PERFORMANCE OF *CRYPTOMERIA JAPONICA* IN HILLS OF WEST BENGAL

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Cryptomeria japonica, an exotic was first brought to Darjeeling by Mr. Fortune in 1844 from China and has spread across hill slopes in West Bengal till about mid-thirties of the century when an assessment showed that this species had grown too fast belying the hopes of good and quality timber for which it had been grown in replacement of some natural hard-woods. As a consequence, a decline followed and in the next decade it was virtually banned from the plantations. Recent technological advancement and industrial expansion in commercial environment created pressure on varied types of raw materials. Investigations revealed that *Cryptomeria* is suitable for paper and pulp industry (Guha, Dhondiyal *et al.*, 1970) so it came back from exile. It is grown today in elevation ranging from about 1500 m and 2400 m, the best growth falling between 1800 m and 2000 m.

The growth behaviour of *Cryptomeria* has been quoted in various papers with reference to specific localities but no attempt has till now been made to correlate its growth in different productive sites. The average M.A.I. has been reported about 22 m^3 and the highest as 43.5 m^3 at 60 years of age. This paper presents growth pattern of *Cryptomeria* under varying conditions.

Data to determine species dependent coefficients of growth models were derived from 27 Permanent sample plots (S.P. No. 6, 24, 26, 27, 31, 32, 33, 39, 40, 41, 44, 45, 46, 47, 48A, 48B, 49, 50, 51, 52 & 53 of Darjeeling Division; S.P. No. 16, 19, 38, 39 & 40 of Kurseong Division and S.P. No. 26 of Kalimpong Division). In all there were 100 measurements. Mean and standard deviation of basic parameters used are given here-under so as to indicate size and range of data.

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Parameter	Mean	Standard deviation	Denoted in text by	Units
Age	30.0	12.3	A	yrs
Top height	19.1	10·9	H	m
Crop diameter (before thinning)	.258	.099	D2	m
Standard timber volume/ha (before thinning)	425.65	340.62	V1+ V3	m^3
Total volume/ha (before thinning)	621.86	328.47	V2+V4	m^3
Basal area ratio	.854	.212	BA/BA_{Max}	—
Number of trees/ha (before thinning)	1533	654	S1+S2	Number
Standard timber volume/ha (After thinning)	393.74	311.01	V1	m^3
Total volume/ha (after thinning)	562.32	296.00	V2	m^3
Height ratio	1.010	.138	(H/Mean height from curve)	—

Methodology

Following relationships were developed. These relationships are valid for the range covered in basic data.

1. *Site quality function*

$$Log_e\ H = 4.38294 - 6.79859\ A^{-.5}$$
$$r = .909$$

Three site qualities are identified by varying curve index coefficient (i.e. –.5) for reference age of 30 years.

Site quality	Top height (m) at reference age of 30 years
I	27.1
II	23.1
III	19.1

2. *Crop diameter functions*

$$Log_e\ (D2) = .68545\ Log_e\ H + .01063\ A - 3.83584$$
$$r = .932$$

Basal area ratio and its various interactions with age and height were also used but none of them was found to have a significant effect. Probably the species can form dense stands without appreciable loss in diameter growth.

3. *Volume functions*

(a) $V2 + V4 = .35850\ BA.H + 46.31714$
$r = .975$

(b) $V1 + V3 = .33287\ BA.H - .15368\ (S1 + S2) + 526.98706/[2\ \mathrm{Cosh}\ .0037\ (0.0 = BA.H)] + 101.54079$
$r = .981$

(c) $\mathrm{Log}_e\ [V2/(V2 + V4)] = .44989\ \mathrm{Log}_e\ [S1/(S1 + S2)] + .00002$
$r = .831$

(d) $\mathrm{Log}_e\ [V1/(V1 + V3)] = .32139\ \mathrm{Log}_e\ [S1/S1 + S2)] - .00135A + .04503$
$r = .857$

Equation (c) and (d) are aimed to reduce standing volume before thinning to standing volume after thinning. The regression coefficients of these regressions is not high. These figures could not be improved significantly by adding more variables. Probably in thinnings, the removal of thinning has not followed any systematic pattern (i.e. low thinning, mechanical or crown thinning) and hence this situation. Therefore crop volume values will be more reliable than volume after thinnings generated in growth tables.

4. *Maximum basal area curve*

Graph between Top height and basal area/ha was plotted. Free hand curve was drawn to cover the maximum observed values (BA_{Max}). Suitable function to fit points taken from hand drawn curve was found.

$$\mathrm{Log}_e\ (BA_{Max}) = 4.75704 + 2.70572\ \mathrm{Log}_e\ (1 - e^{-.09678\ H})$$

Top height corresponds to the height of a tree of top diameter, where top diameter is mean diameter of 125 thickestt rees/ha.

Maximum basal area. curve help to define capacity of soil and provides a check against simulating unrealistic values.

The yield tables are generated from these regressions for three quality classes (Annexure). Two constraints were imposed in generating tables. These are that number of trees in lower quality cannot be less than the number for the same age in superior quality and secondly that the preceeding age class cannot have less trees than the succeeding one.

Conclusion

This species is the fastest grown exotic tree in Eastern Himalaya. The maximum mean annual increment per hectare of *Cryptomeria japonica* for maximum volume production varies between 22.8 to 38.4 m^3 depending upon yield capacity of the site. In good quality areas, the rotation for harvest is indicated as about 35 to 40 years whereas in poor sites, it may be as high as 55–60 years. The study also indicates that initial planting spacement should be kept about 2 m×2 m.

Annexure

Age (yrs.)	Top height (cm)	Crop diameter (cm)	No. of trees/ha.	Basal area per ha (m^2)	Volume/ha (m^3) Standard timber	Volume/ha (m^3) Total wood	Thinning Volume (m^3) Standard timber	Thinning Volume (m^3) Total wood	M.A.I. (m^3) Standard timber	M.A.I. (m^3) Total wood
1	2	3	4	5	6	7	8	9	10	11
					Site Quality I					
5	4.6	6.5	3068	10.19	0	63.113	0	—	0	12.623
10	11.2	12.6	3068	38.44	0	201.644	0	11.846	0	20.164
15	16.6	17.3	2682	63.40	49.897	422.978	1.920	36.026	3.326	28.988
20	20.8	21.4	2200	78.93	310.751	634.527	14.084	54.697	15.633	34.120
25	24.2	25.0	1801	88.62	539.598	815.960	26.400	67.232	22.223	36.741
30	27.1	28.5	1487	94.93	729.289	968.551	37.998	75.560	25.722	37.945
35	29.5	31.9	1242	99.23	886.759	1097.500	49.286	81.255	27.633	38.367
40	31.7	35.3	1047	102.29	1019.075	1207.705	60.617	85.322	28.719	38.358
45	33.5	38.7	889	104.54	1131.788	1303.061	72.175	88.358	29.379	38.111
50	35.2	42.2	761	106.24	1229.043	1386.533	—	—	29.830	37.737

(Cond.)

1	2	3	4	5	6	7	8	9	10	11
					Site Quality II					
5	3.8	5.7	3068	7.83	0	56.987		—	0	11.397
10	9.3	11.1	3068	29.70	0	145.341	0	6.505	0	14.534
15	13.8	15.3	2771	57.03	0	298.952	0	20.170	0	20.364
20	17.5	19.0	2373	67.08	133.977	466.515	5.014	35.267	6.699	24.660
25	20.5	22.3	1992	78 06	329.936	620.502	14.530	47.028	13.398	27.298
30	23.1	25.5	1672	85.72	504.057	756·173	24.705	55.807	17.453	28.838
35	25.3	28.7	1410	91.21	654.037	874.596	35.062	62.385	19.951	29.696
40	27.3	31.8	1196	95.28	783.041	978.204	45.599	67.417	21.559	30.134
45	29.0	35.0	1020	98.36	894.712	1069.435	50.367	71.367	22.658	30.311
50	30.6	38.3	875	100.76	992.185	1150.380	—	—	23.469	30.327
					Site Quality III					
5	3.1	4.9	3068	5.79	0	52.749	0	—	0	10.550
10	7.5	9.5	3068	21.76	0	104.812	0	4.691	0	10.481
15	11.2	13.2	2771	37.94	0	198.637	0	9.531	0	13.555
20	14.3	16.5	2484	53.14	3.870	317.977	.104	19.512	.194	16.610
25	16.9	19.5	2158	64.60	141.846	436.752	5.212	28.865	5.678	18.819
30	19.1	22.4	1853	73.22	285.198	547.650	12.557	36.693	9.683	20.342
35	21.1	25.3	1588	79.79	417.779	648.688	20.917	43.113	12.448	21.371
40	22.8	28.2	1363	84.89	536.529	739.993	29.874	48.383	14.383	22.060
45	24.3	31.1	1173	88.91	642.085	822.432	39.258	52.752	15.795	22.516
50	25.1	34.0	1012	92.15	735.970	897.041	—	—	16.818	22.817

Note:—Values in Col. 2 to 7 pertain prior to thinnings.

SUMMARY

The growth of *Cryptomeria japonica* has been quoted in the past with reference to specific localities but no attempt was made to estimate its growth in different productive sites. The paper presents growth pattern of *Cryptomeria* under varying conditions.

पश्चिम बंगाल की पहाड़ियों में क्रिप्टोमेरिया जैपोनिका की वृद्धि सक्रियता

लेखक एस०पी० सिंह, आर०एस० शर्मा, एम०सी० मित्तल व जयसिंह

सारांश

क्रिप्टोमेरिया जैपोनिका की वृद्धि का उल्लेख विगत में विशिष्ट स्थलों के संदर्भ में किया मिलता है परन्तु विभिन्न उत्पादकता स्थानों के लिए इसकी वृद्धि का आकलन करने का कोई प्रयत्न नहीं किया गया है। इस अभिपत्र में विभिन्न दशाओं में क्रिप्टोमेरिया की वृद्धि की रूप सज्जा प्रस्तुत की गई है।

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PREHYDROLYSIS OF BAMBOO—EFFECT OF pH

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Introduction

In order to prepare high alpha-cellulose pulp suitable for rayon manufacture, the wood should be prehydrolyzed with mineral acids, water or alkali and then digested by conventional kraft process. The purpose of prehydrolysis, is to remove pentosans and ash to the maximum extent possible.

In acid prehydrolysis, the temperature is usually kept at 120–140°C while water-prehydrolysis is carried out at higher temperatures 150 to 180°C for 1–4 hrs. Acid generated during the prehydrolysis lowers the pH value to 4 or below in case of water-prehydrolysis. Phrix Werke Agco Process (1941) used sulphuric acid concentration from 0.5 to 1% at 120 to 140°C. Karnile and Sen (1948) produced pulp of low ash content (0.14% to 0.21%) from bamboo using hydrochloric acid, whereas Joglekar and Donofrio (1951) used sulphuric acid. The main advantage of acidic prehydrolysis is that the hemicelluloses dissolve as sugars and the cellulose obtained is purer. The inorganic salts are removed and calcium content of the pulp can also be lowered. The time of prehydrolysis is adjusted in such a way that the reaction is stopped at a point where a considerable part of lignin has been removed.

The purpose of water-prehydrolysis is to break, weaken, soften or otherwise destroy the bonds between the fibres in wood to permit their more or less ready seperation. This treatment is highly effective in removal of pentosans and non-cellulosic materials which are soluble in ether as shown by Guha and *et al.*, 1977.

In alkaline prehydrolysis, the wood acids are neutralized in the initial stages of prehydrolysis result in formation of path for uniform cooking. Singh and Bhola (1968) has used the process for manufacture of rayon grade pulp from hardwoods.

The present work was undertaken to study the nature of acidic, aqueous and alkali lignins which were isolated from the prehydrolysates, using bamboo as raw material.

Experimental

Bamboo *(Dendrocalamus strictus)* culms were obtained from the demonstration area of Forest Research Institute, Dehra Dun. The culms were air dried and chipped.

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Prehydrolysis of Bamboo. The prehydrolysis of chips was carried out by 1% H_2SO_4, H_2O and 10% NaOH solution for 90 minutes and 150 minutes. In each case chips (300 g. o. d.) were cooked in a stationary autoclave of 3 litre capacity. The cooking conditions used for prehydrolysis are given in Table 1.

Table 1

Prehydrolysis of bamboo using different Prehydrolyzing agents at different cooking time.
(Prehydrolysis agents used on o.d. weight of bamboo)

Particulars	Unit	Prehydrolyzing agents					
		1% H_2SO_4		H_2O		10% NaOH	
		A	B	A	B	A	B
Prehydrolysing temperature	°C	130	130	170	170	170	170
Bath ratio		1 : 4	1 : 4	1 : 4	1 : 4	1 : 4	1 : 4
Time to maximum temperature	min.	90	90	90	90	90	90
Time at maximum temperature	min.	0	60	0	60	0	60

After completion of a cook the pressure was released and the contents were cooled to room temperature. The mixture was filtered over double folded muslin cloth. The pH of the liquor was measured. The residual wood was washed with distilled water. The liquor and washings were collected and filtered over 1 G 3 crucible. The yield of prehydrolysed chips was determined by finding out its moisture content. The acidic and aqueous lignin were isolated from black liquor by the method of Harris and Mitchell (1938) and Lyness and Scheuker (1957) respectively in which the supernant liquor was treated with alkali and then acidified by acetic acid. In case of acidic lignin the acidified solution was added to large volume of water which caused the lignin to precipitate out. The alkali lignin was isolated from black liquor by acidification with dilute hydrochloric acid. The soda lignin was isolated by centrifuging the solution and soda lignin was purified by Ahlm's method (1941).

Analysis of lignins. The lignin samples were analysed for carbon and hydrogen (Kemmerer and Whittenberger (1940), methoxyl content by Tappi method, total hydroxyl content(Whistler and Jeans 1945) phenolic hydroxyl content (Daub and *et al.*, 1947) and Klason lignin content (by Tappi method). The nitrobenzene oxidation of soda lignin was carried out under the following reaction conditions :–

Reaction temperature, °C	—	170
Time, hours	—	3
Nitrobenzene, ml	—	4
Sodium hydroxide (2N), ml	—	3

The oxidized products were isolated by dichloromethane and were analysed after silylation by using Gas-liquid-chromatography.

Results and discussion

Table 2 shows the pulp yield and final pH of the liquor at different cooking time. In Fig. 1 and 2 the pulp yield has been plotted against initial and final pH of liquor respectively.

Table 2

Variation of pulp yield with pH of liquor at different cooking time

Cooking chemical	Maximum temperature (°C)	90 minutes			150 minutes		
		Pulp yield* (%)	pH of liquor		Pulp yield* (%)	pH of liquor	
			Initial	Final		Initial	Final
1% H_2SO_4	130	93.10	1.8	4.6	93.48	1.8	3.6
H_2O	170	84.80	7.0	5.2	81.60	7.0	4.3
1% NaOH	170	75.65	13.0	12.0	68.00	13.0	11.2

* On the basis of oven-dry wood.

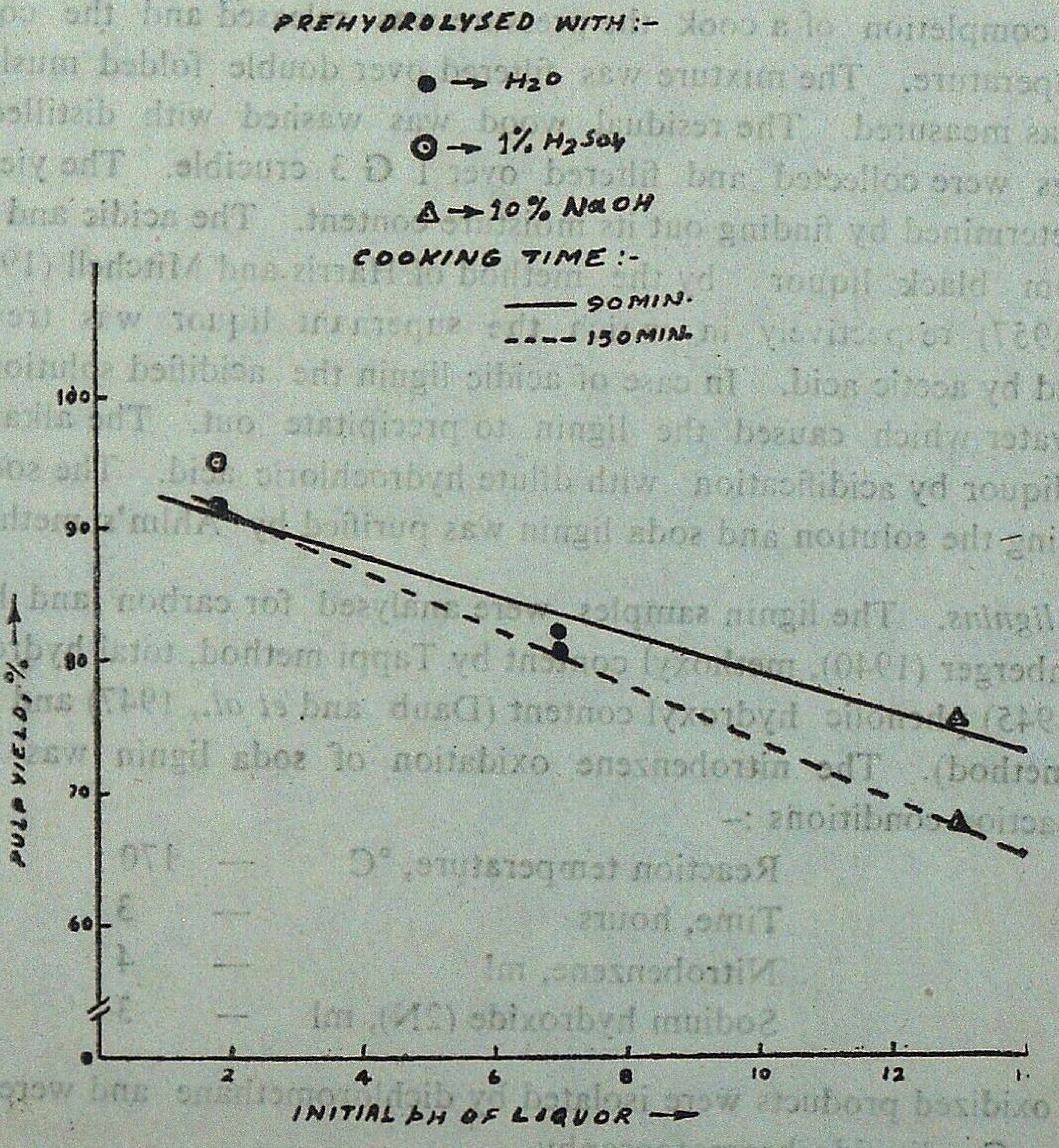

Fig. 1—Change in Pulp yield with pH using different Prehydrolysing agents.

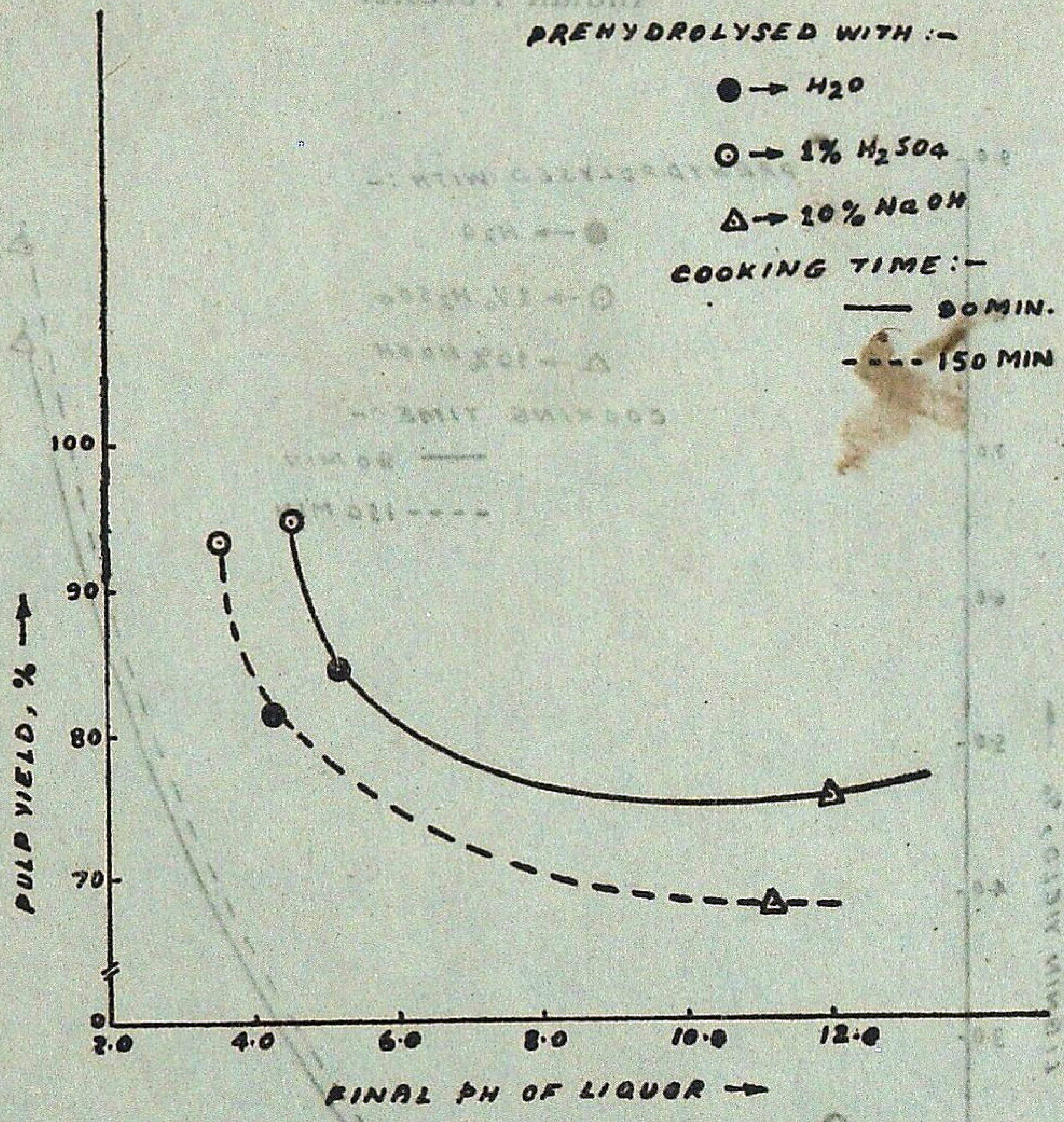

Fig. 2—Relationship between Pulp yield and final pH of liquor.

From Table 2 and Fig. 1, it is seen that pulp yield decreases at higher pH and cooking time. Fig. 2 indicates that pulp yield is also affected by the final pH of liquor. The yield decreases as the final pH and cooking time are higher. It is also evident that the pH of the liquor goes toward acidic side if we increase the cooking time. The changes in pH value depend upon the fatty acids (mainly acetic acid) produced, which accelerate the hydrolysis.

Table 3 shows the yield of lignin obtained from different prehydrolysates and the amount of Klason lignin in the lignin samples. Fig. 3, indicates change in yield of lignin with pH of the cooking liquor.

Table 3

Yield of lignin obtained from different Prehydrolyzates at different cooking time

Cooking chemical	Maximum temperature (°C)	Cooking time					
		90 minutes			150 minutes		
		Yield* (%)	Yield** (%)	Klason lignin (%)	Yield* (%)	Yield** (%)	Klason lignin (%)
1% H_2SO_4	130	2.00	2.79	0.43	2.40	9.25	0.46
H_2O	170	1.46	5 69	1.69	1.73	6.70	3.54
10% NaOH	170	7.70	30.00	86.09	8.40	32.75	88.41

* On the basis of oven-dry wood. ** On the basis of Klason lignin.

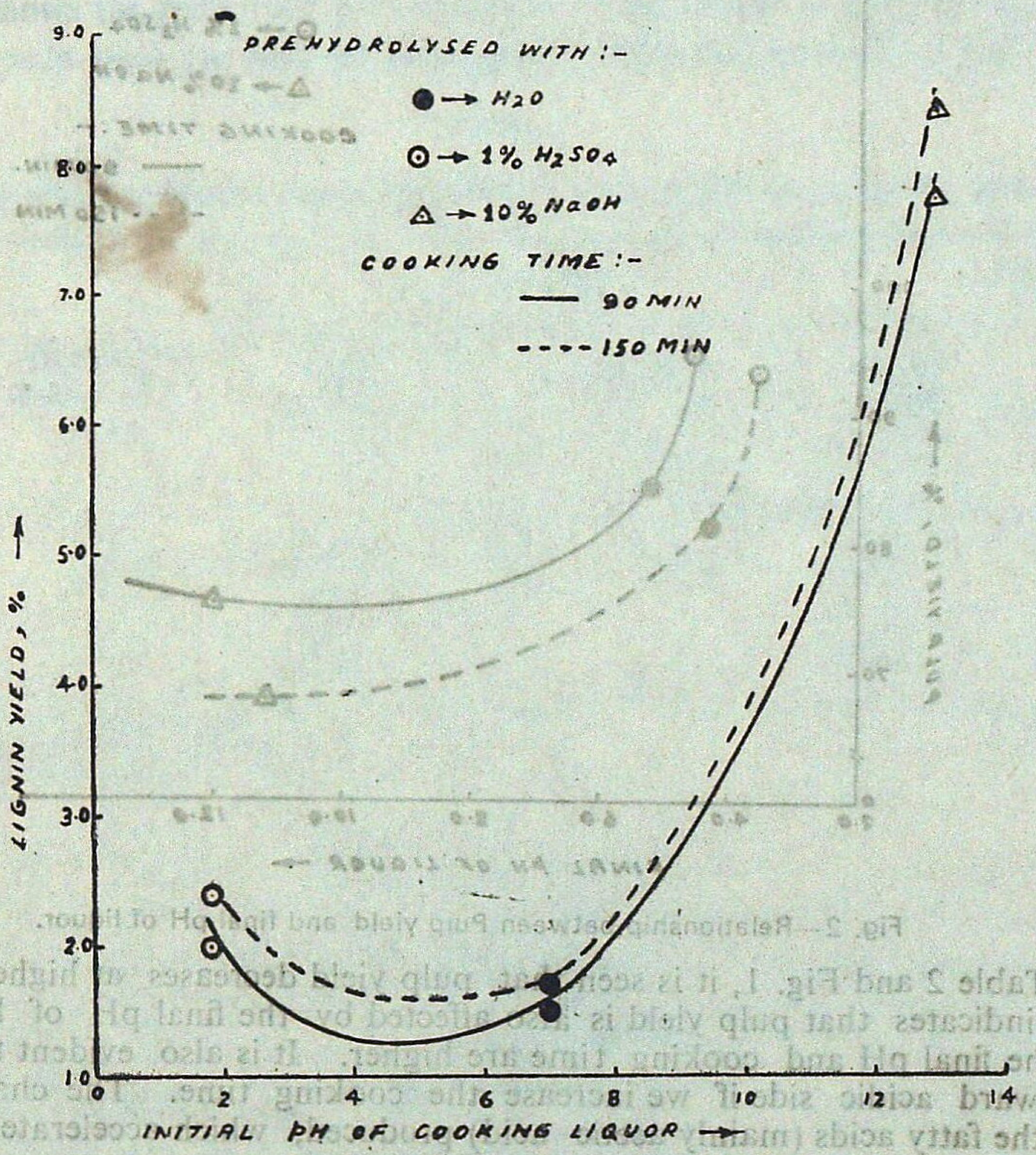

Fig. 3—Relationship between Lignin yield and initial pH of cooking liquor.

From Table 3 and Fig. 3, it is concluded that lignin yield decreases as the pH goes toward the acidic side. It has a minimum value at pH 5. The increase in lignin yield has also been observed at very low pH. At higher cooking time, more delignification is observed. The amount of Klason lignin in these lignins show that alkali lignin is in pure state, while in case of acidic and aqueous lignin the low value indicates that unstable carbohydrates are also precipitated as impurity alongwith lignin.

Table 4 and 5 show the elemental composition and functional groups of these lignins obtained from different prehydrolyzates. In Fig. 4 and 5 methoxyl and total-OH content of the lignin has been plotted against lignin yield respectively, while Fig. 6 the graph has been plotted against methoxyl content and total-OH.

Table 4

Elemental composition and chemical analysis of lignins obtained from different Prehydrolyzates at 90 minutes

Sl. No.	Cooking chemical	Maximum temp. (°C)	Elemental compositon and chemical analysis of lignin						
			Carbon (%)	Hydrogen (%)	Oxygen (%)	Methoxyl (%)	Total-OH (%)	ph-OH (%)	Alc-OH (%)
1.	1% H_2SO_4	130	13.10	9.10	77.80	1.90	3.42	—	—
2-	H_2O	170	11.40	9.23	79.37	1.14	2.14	—	—
3.	10% NaOH	170	59.84	5.70	34.40	7.65	8.12	1.82	6.30

pH—OH indicates phenolic hydroxyl group.
Alc—OH indicates alcoholic hydroxyl group.

Table 5

Elemental composition and chemical analysis of lignins obtained from different Prehydrolysis at 150 minutes

S. No.	Cooking chemical	Maximum temp. (°C)	Elemental composition and chemical analysis of lignins						
			Carbon (%)	Hydrogen (%)	Oxygen (%)	Methoxyl (%)	Total-OH (%)	pH-OH (%)	Alc-OH (%)
1.	1% H_2SO_4	130	17.00	12.70	70.30	0.90	4.72	—	—
2.	H_2O	170	10.40	6.70	82.90	1.30	5.13	—	—
3.	10% NaOH	170	59.98	5.96	34.06	7.50	12.42	2.32	10.10

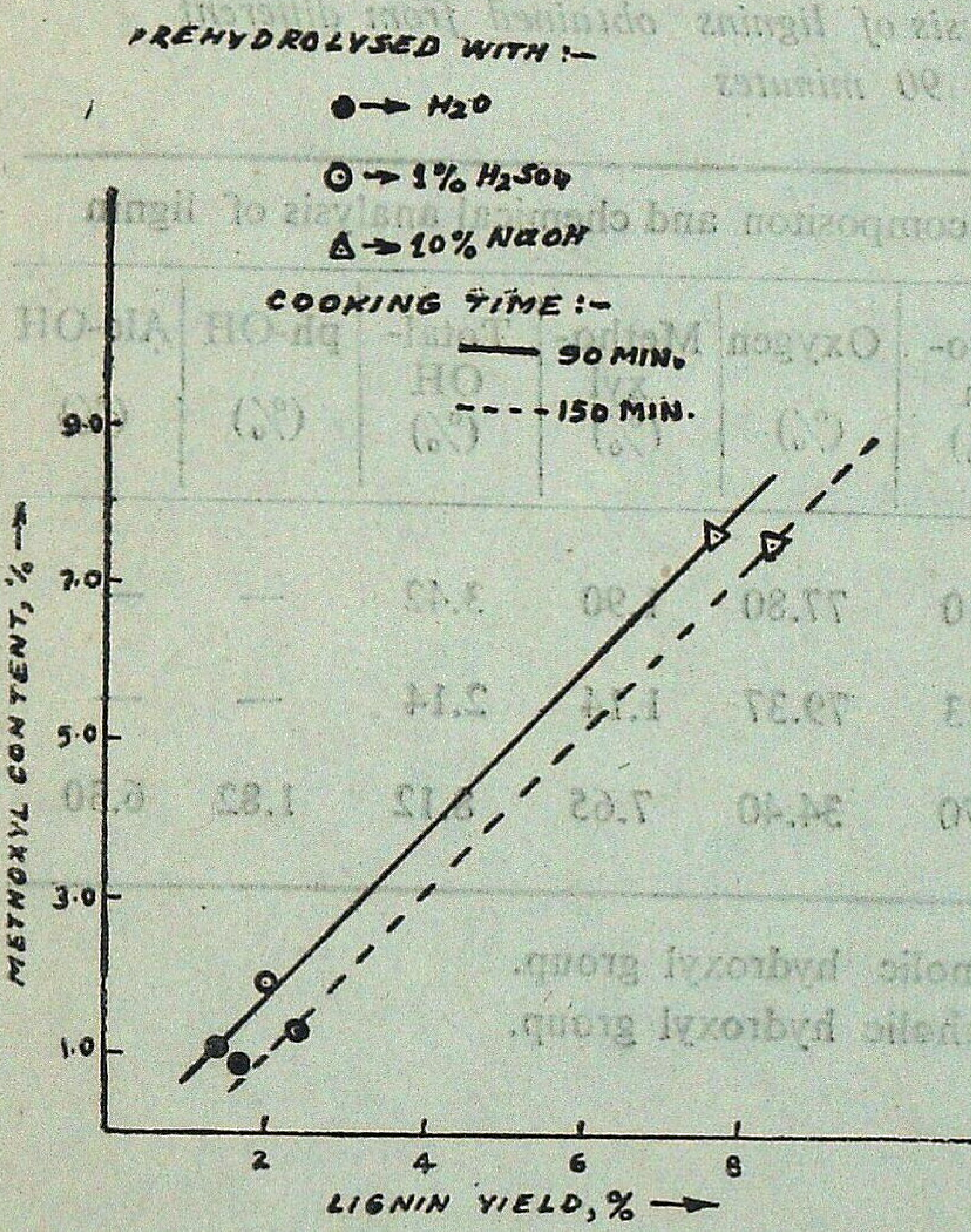

Fig 4—Relationship between Methoxyl content and lignin yield using different Prehydrolysing agents at different cooking time.

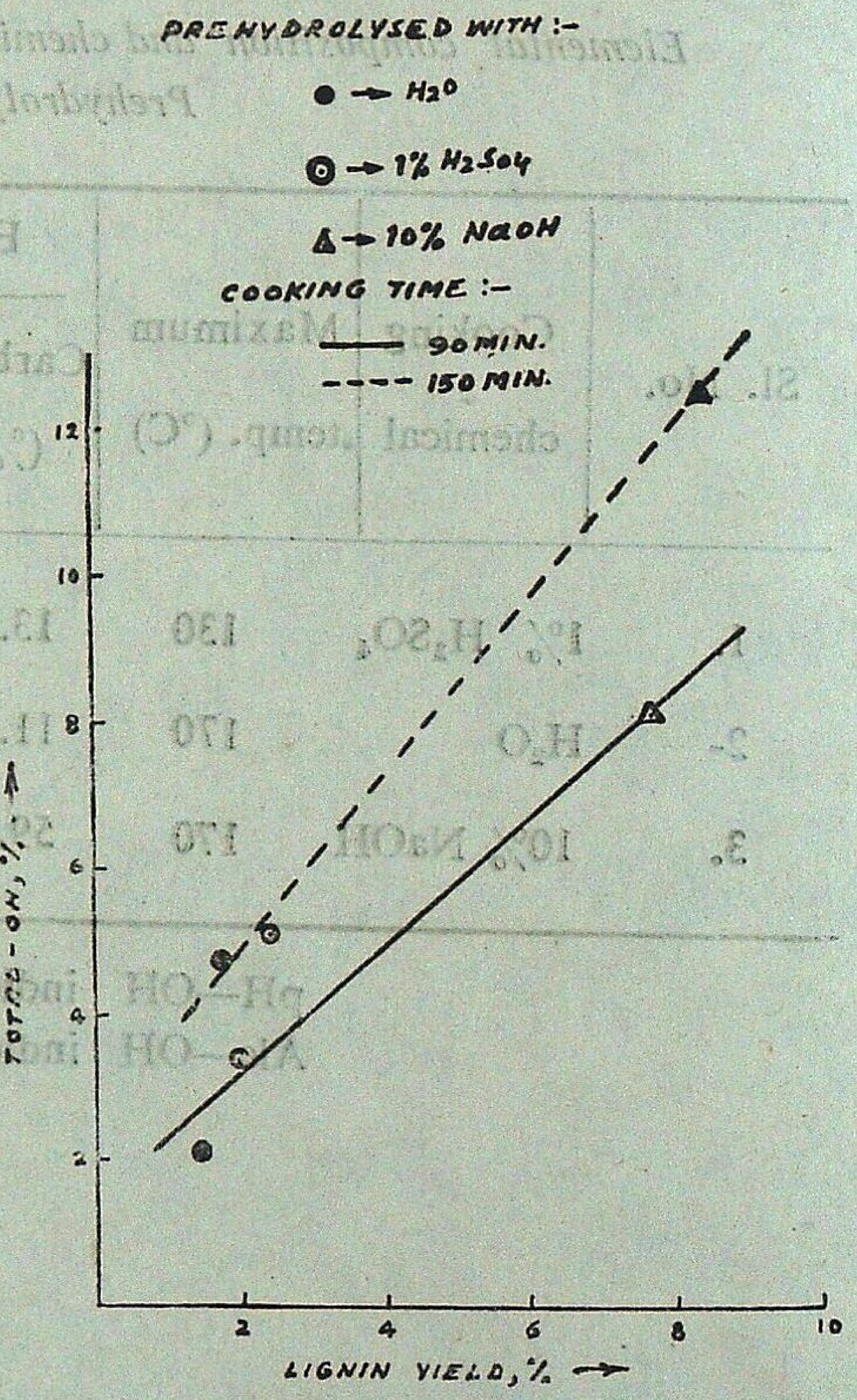

Fig. 5—Relationship between total OH and lignin yield using different Prehydrolysing agents at different cooking time

From Table 4, 5 and Fig 4 and 5, it is observed that methoxyl and total – OH values have linear relationship with lignin yield. The methoxyl value decreases at higher cooking time while total–OH increases with cooking time. This may be due to the fact that methoxyl groups are being converted into hydroxyl groups. The formation of now hydroxyl groups may occur either by hydrolysis of a phenolic, enolic or acidic methoxyl group with simultaneous formation of methanol by opening of a furan or pyran ring or the combination of the two reactions as discussed by Brauns and Grimes 1939.

Demethylation also occurs more in case of alkaline prehydrolysis than acidic prehydrolysis. A similar trend has been fouud in case of total – OH groups, as it has a higher value in alkaline prehydrolysis. This reaction has been supported by the trend in Fig. 6 which shows that methoxyl value and total–OH have a linear relationship.

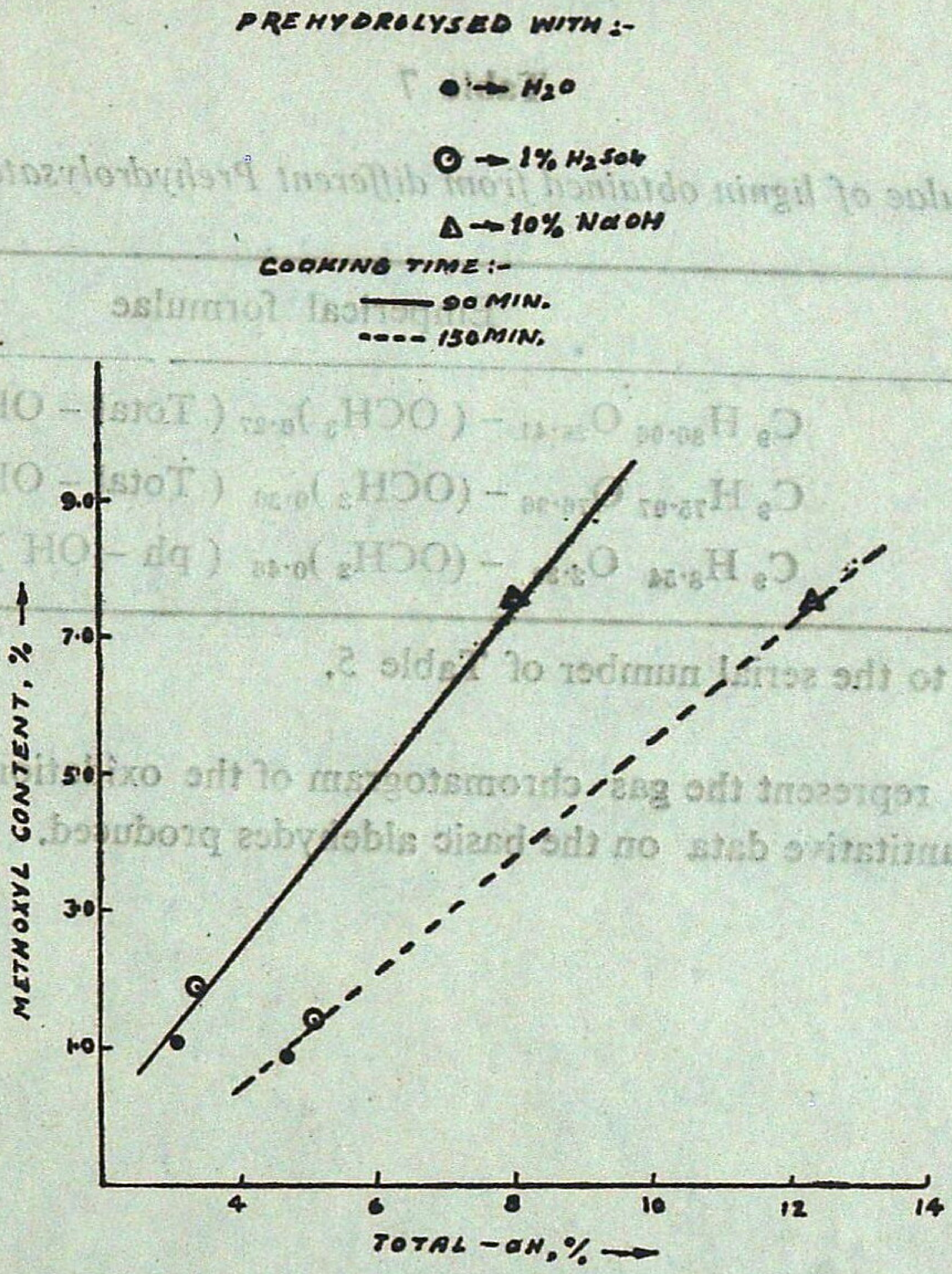

Fig. 6—Relationship between Methoxyl content and total-OH using different Prehydrolysing agents at different cooking time.

From Table 4 and 5, it is observed that carbon and hydrogen of the prehydrolysed lignins obtained from 1% H_2SO_4 and H_2O, have lower value than the lignins obtained from 10% NaOH. Moreover the lingnins obtained from 1% H_2SO_4 and H_2O are not soluble in alkali. It is observed from Table–4 and 5 that the value of total–OH content is also increased by increasing the prehydrolysis time.

Table 6 and 7 show the emperical formulae of these lignins obtained from different prehydrolysates at different cooking time. It will be seen from the data in Table 6 that for water prehydrolysate is in less condensed state as compared to alkali lignin which has lower value of hydrogen content.

Table 6

Emperical formulae of lignins obtained from different Prehydrolysate at 90 minutes

Sl. No*	Emperical formuale
1.	$C_9\,H_{77\cdot78}\,O_{40\cdot99}$ — $(OCH_3)_{0\cdot53}$ (Total — OH)$_{1\cdot78}$
2.	$C_9\,H_{88\cdot92}\,O_{47\cdot44}$ — $(OCH_3)_{0\cdot40}$ (Total — OH)$_{1\cdot28}$
3.	$C_9\,H_{8\cdot47}O_{2\cdot70}$ — $(OCH_3)_{0\cdot47}$ (ph — OH)$_{0\cdot20}$ (Alc — OH)$_{0\cdot70}$

* This corresponds to the serial number of Table 4.

Table 7

Emperical formulae of lignin obtained from different Prehydrolysates at 150 minutes

Sl No.*	Emperical formulae
1.	$C_9\ H_{80\cdot06}\ O_{26\cdot41} - (OCH_3)_{0\cdot27}\ (\text{Total} - OH)_{1\cdot97}$
2.	$C_9\ H_{75\cdot07}\ O_{76\cdot96} - (OCH_3)_{0\cdot36}\ (\text{Total} - OH)_{3\cdot29}$
3.	$C_9\ H_{8\cdot54}\ O_{3\cdot80} - (OCH_3)_{0\cdot46}\ (ph - OH)_{0\cdot26}\ (Alc - OH)_{1\cdot22}$

* It corresponds to the serial number of Table 5.

Figs. 7 and 8 represent the gas chromatogram of the oxidation of isolated lignins and Table 8 gives the quantitative data on the basic aldehydes produced.

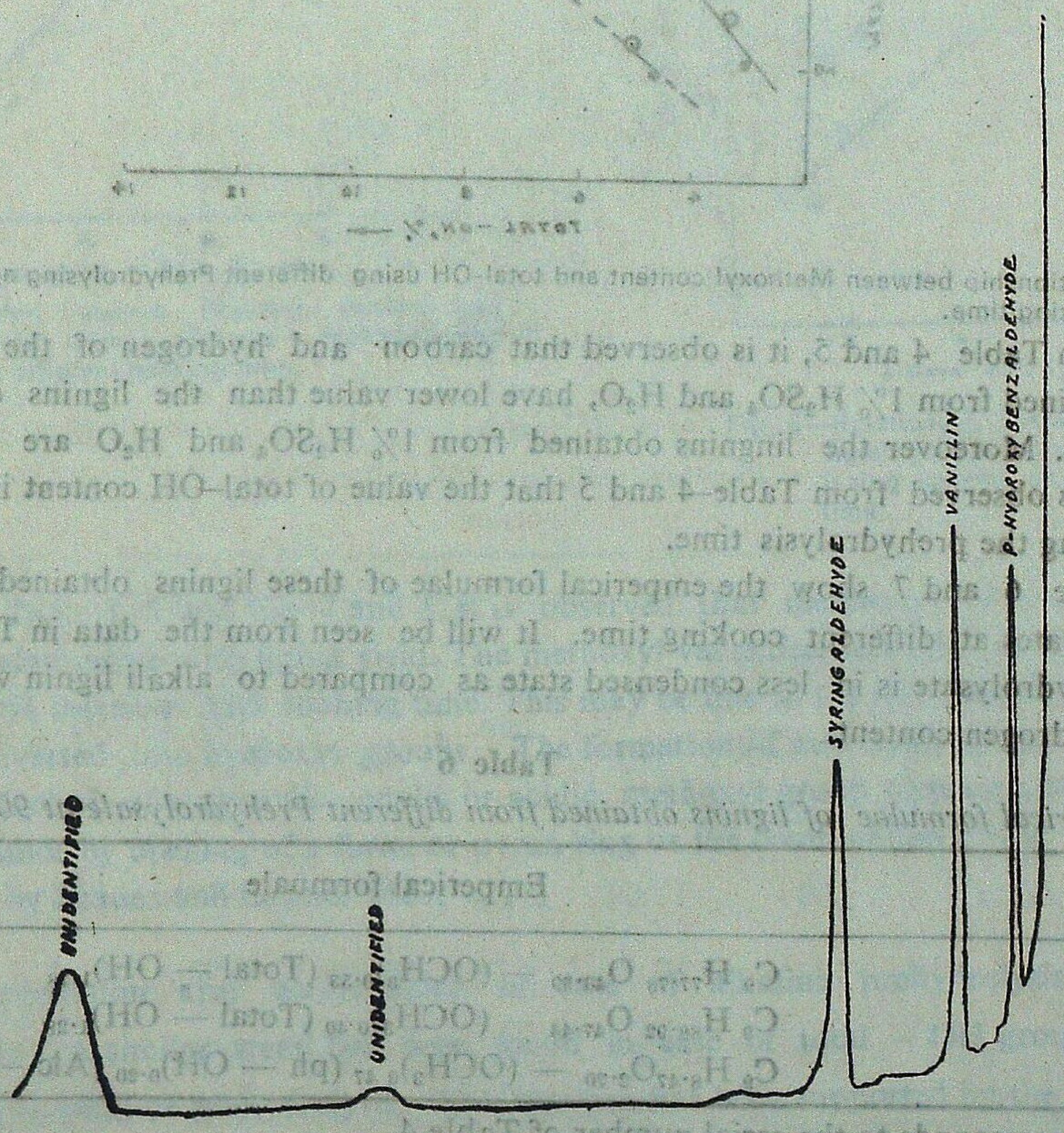

Fig. 7—Gas chromatogram of oxidation products of soda lignin obtained by cooking with 10% NaOH for 90 minutes at 170°C

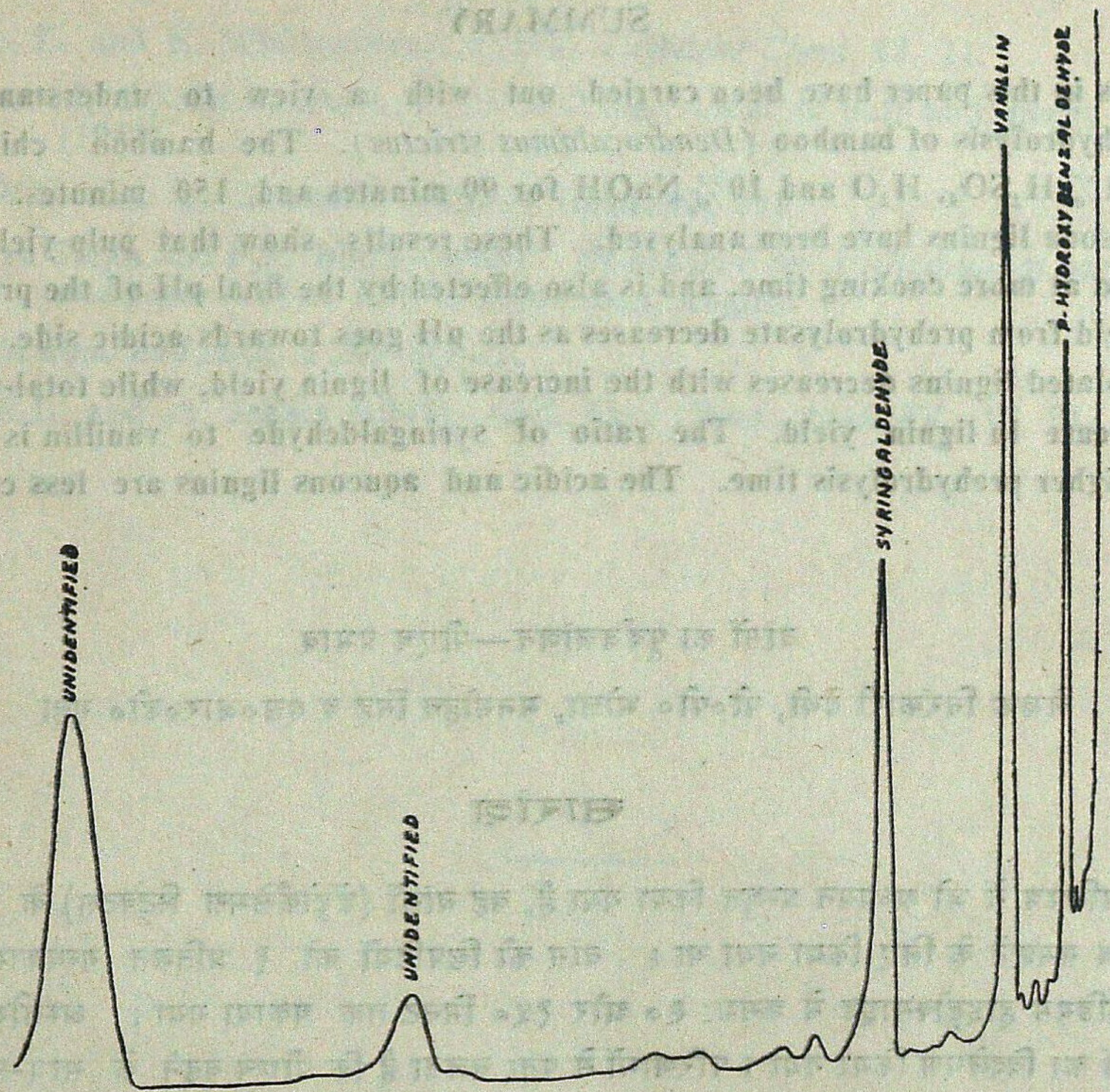

Fig. 8—Gas chromatogram of oxidation products of soda lignin obtained by cooking with 10% NaOH for 150 minutes at 170°C

From Table 8 it is observed that the value of S/V ratio is less at higher cooking time. Higher is the S/V ratio the more are the syringyl units in lignin and therefore the lesser are the positions available for internal condensation reactions.

Table 8

Nitrobenzene Oxidation products of lignins (10% NaOH) at different cooking time

Sl. No.	Component	Cooking time, minutes	
		90	150
1.	p-hydroxybenzaldehyde	0.92	1.25
2.	Vanillia	1.808	2.848
3.	Syringaldehyde	2.982	4.302
4.	Total yield	5.72	8.400
5.	S/V ratio	1.64	1.51

SUMMARY

Studies in this paper have been carried out with a view to understand the effect of pH on prehydrolysis of bamboo *(Dendrocalamus strictus)*. The bamboo chips have been cooked with 1% H_2SO_4, H_2O and 10% NaOH for 90 minutes and 150 minutes. The acidic, aqueous and soda lignins have been analysed. These results show that pulp yield decreases at higher pH and at more cooking time, and is also effected by the final pH of the prehydrolysates. The lignin yield from prehydrolysate decreases as the pH goes towards acidic side. The met'ıoxyl content in isolated lignins decreases with the increase of lignin yield, while total-OH increases with the increase in lignin yield. The ratio of syringaldehyde to vanillin is less in lignins obtained at higher prehydrolysis time. The acidic and aqueous lignins are less condensed than soda lignin.

बांसों का पूर्वजलांशन—पीएच प्रभाव

लेखक निरंकारी देवी, पी०पी० भोला, मनमोहन सिंह व एस०आर०डी० गुहा

सारांश

इस अभिपत्र में जो अध्ययन प्रस्तुत किया गया है, वह बांसों (डेंड्रोकैलेमस स्ट्रिक्टस) के पूर्वजलांशन पर पीएच का प्रभाव समझने के लिए किया गया था। बांस की छिपटियों को १ प्रतिशत गन्धकाम्ल, पानी तथा १० प्रतिशत सोडियम हाइड्रोक्साइड में क्रमश: ९० और १५० मिनट तक पकाया गया। अम्लीय, जलीय और सोडीय लिग्निनों का विश्लेषण किया गया। परिणामों से पता चलता है कि पीएच बढ़ने के साथ-साथ लुगदी की प्राप्ति घटती जाती है, पकाने में समय अधिक लगता है और पूर्वजलांशित पदार्थों के अंतिम पीएच से भी वह प्रभावित होता है। पीएच के अम्लता की ओर चलने पर पूर्वजलांशित पदार्थों से लिग्निन की प्राप्ति घटने लगती है पर कुल ओएच की मात्रा बढ़ने के साथ लिग्निन प्राप्ति की मात्रा भी बढ़ती है। पूर्वजलांशन में अधिक समय लगाकर प्राप्त की गई लिग्निनों में सिरिंगएल्डिहाइड का वैनिलिन से अनुपात कम रहता है। सोडा लिग्निन के मुकाबले में अम्लीय और जलीय लिग्निन कम संघनित होती है।

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A STUDY OF FOLIAR AND SOIL NUTRIENT STATUS OF *SALVADORA PERSICA* LINN. IN THE THAR DESERT OF INDIA

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Introduction

Much attention has been given in recent years to the effect of concentration of cations in the soil and on the nutrients taken up by the plant. Such an information is not much available for the phanerophytes of the arid regions. The object of this paper is to correlate the nutrient content of the leaves of *Salvadora persica* with the exchangeable cations in the soil.

Salvadora persica L. is a small evergreen tree rarely exceeding 5 m to 6 m in height. It forms an important component of the flora of the Thar Desert in India and also has a wide distribution Baluchistan, Sind, Ceylon and Egypt (Duthie, 1960). The area (Churu in the Bikaner Division of Rajasthan) where this investigation was carried out, has a vast expanse of sand all around with accumulations at many places leading to the formation of dunes. The climate is characterized by scanty and irregular rainfall mainly received during the monsoon season (July to September); high temperature during the summer and almost freezing temperature in the winter season, and a high wind velocity during the summer.

Methods of Study

Two soil pits 100 × 100 × 75 cm were dug near each plant at five sites and soil samples were collected from the surface to 10 cm, 15 to 25 cm, 30 to 40 cm, 45 to 55 cm and 60 to 70 cm depth from the exposed profiles. Composite samples (Allen, 1974) at each site were analysed for exchangeable calcium, magnesium, potassium and sodium, available phosphorus, total nitrogen, carbonates, organic carbon and pH. The soil colour was recorded based on Munsell soil colour charts.

Leaf samples were collected at the same time from the plants growing at five sites. The plants were not in the flowering condition at the time of collection. Only fully developed and healthy leaves were collected. They were dried, powdered and ashed for analysis of calcium, magnesium, potassium, sodium, nitrogen and phosphorus. The analyses of soil and plant samples were carried out according to the methods suggested by Piper (1944).

Results and discussion

Table 1 gives details of certain properties of soil supporting *Salvadora persica.* These soils are mostly light yellowish brown and yellowish brown in colour. The lower samples in some profiles have brownish yellow and reddish yellow (in the samples from depressions

Table 1

Soil characteristics under Salvadora persica L. in the Thar Desert of India.

Habitat	Soil character	Soil depth				
		Surface 0–10 cm	15–25 cm	30–40 cm	45–55 cm	60–70 cm
1. Sandy Plain	Colour (M)	10 YR 6/4	10 YR 6/4	10 YR 6/4	10 YR 6/5	10 YR 5/4
	pH	7.4	7.4	7.5	7.5	7.5
	Organic Carbon (%)	0.3				
2. Sandy Plain	Colour (M)	10 YR 6/4	10 YR 5/4	10 YR 6/4	10 YR 6/5	10 YR 5/4
	pH	7.3	7.4	7.4	7.5	7.5
	Organic Carbon (%)	0.54				
3, Sandy Plain	Colour (M)	10 YR 5/4	10 YR 5/6	10 YR 6/6	10 YR 5/6	10 YR 6/6
	pH	7.0	7.5	7.5	7.7	7.6
	Organic Carbon (%)	0.78				
4. Sandy Plain	Colour (M)	10 YR 6/4	10 YR 6/4	10 YR 5/6	10 YR 5/4	10 YR 6/6
	pH	7.0	7.2	7.4	7.7	7.2
	Organic Carbon (%)	0.54				
5. Depression	Colour (M)	10 YR 5/4	10 YR 5/4	10 YR 5/6	7.5 YR 7/6	7.5 YR 7/6
	pH	8.2	8.2	8.25	8.1	8.2
	Organic Carbon (%)	0.27				

10 YR 6/4 — Light yellowish brown
10 YR 6/5 — Light yellowish brown
10 YR 6/6 — Brownish yellow
10 YR 5/4 — Yellowish brown
10 YR 5/6 — Yellowish brown
7.5 YR 7/6 — Reddish yellow

only). The soils are coarse, sandy and alkaline, with pH ranging from 7.0 to 8.25. The pH increasad slightly with depth down the profile. Waheedkhan and Yadav (1962) in their investigation on *Salvadora oleoides* reported soil pH varying from 8.46 to 8.61 but such high values were not observed in this study except in the samples collected from depressions. The organic carbon consent varies from 0.27 to 0.78 per cent due to the sparseness of vegetation in the region.

The average contents of exchangeable nutrients depthwise and sitewise have been given in Table 2. It can be seen that the contents of exchangeable calcium, sodium and of available phosporus do not change appreciably with soil depth, whereas, exchangeable magnesium and potassium decrease. For total nitrogen and carbonates the top soil had a lower concentration than the lower horizons. A low content of nitrogen is more likely due to a sparse vegetation cover. Carbonates are quite soluble and leaching and subsequent accumulation in lower horizons is understandable, which leads to a leaching gradient, reported by earlier workers also in dune habitats (Wills *et al.* 1959 a, b; Chandapillai, 1970 and Pemadasa *et al.* 1974).

The content of phosphorus and nitrogen in these soils supporting *Salvadora persica*, is usually low. Wild (1958) attributed comparatively low content of phosphorus, to losses by leaching under existing and earlier environmental conditions. The tree was mostly observed on the sandy plains and was rare in depressions. In the latter site the nitrogen content was higher probably due to accumulated litter and other dried vegetation. However, there was no appreciable difference in the content of phosphorus.

The content of potassium is higher than that of nitrogen or phosphorus. Exchangeable potassium decreases with depth, with higher content at the surface layers probably due to the action of plant residue Titus and Boynton (1953) and Pratt *et al.* (1957) also found a better index of potassium availability in the soil samples of the deeper horizons than of the surface horizons. The lower concentration in deeper horizons therefore indicates the coping up of the plant with whatever little amount of potassium available. The comparison among sites indicates that the depression has comparatively lesser potassium than the sandy plain areas. The same is seen with respect to sodium, calcium and magnesium. It may be accounted for the leaching action which is more pronounced in the case of latter.

A comparison of the status of various elements in the soil both sitewise and depthwise shows the content of magnesium as maximum and of phosphorus and nitrogen minimum. According to Lutz and Chandler (1946) the soils with excessive amounts of magnesium are usually poor in other nutrient elements and such soils commonly have a high pH value which may contribute to the nutritional defficiencies. The same may hold good for the present soils also.

Table 2

Contents of various exchangeable and available nutrients in the soils under Salvadora persica L. growing in the Thar Desert of India

Nutrient element	Depth (cm)	Concentration (m. eq%)		Site	Concentration (m. eq%)		LSD a = 0.05
Calcium	0 — 10	1.93	NS	1	3.52	a	
	15 — 25	1.98	NS	2	2.06	b	
	30 — 40	2.10	NS	3	1.90	c	0.63
	45 — 55	2.12	NS	4	1.97	bc	
	60 — 70	2.28	NS	5	0.96	d	
Magnesium	0 — 10	3.49	a	1	4.65	a	
	15 — 25	3.40	ab	2	2.69	b	
	30 — 40	2.99	bc	3	2.22	b	0.94
	45 — 55	2.06	c	4	2.49	b	
	60 — 70	2.11	c	5	2.00	b	
Potassium	0 — 10	2 96	a	1	2.69	ab	
	15 — 25	2.75	ab	2	2.88	a	
	30 — 40	2.67	abc	3	3.04	a	0.50
	45 — 55	2.30	bc	4	2.06	c	
	60 — 70	2.21	c	5	2.23	bc	
Sodium	1 — 10	2.32	NS	1	2.55	a	
	15 — 25	2.35	NS	2	2.83	a	
	30 — 40	2.18	NS	3	2.35	a	0.55
	45 — 55	2.65	NS	4	2.36	a	
	60 — 70	2.23	NS	5	1.64	b	
Phosphorus	0 — 10	0.09	NS	1	0.08	NS	
	15 — 25	0.08	NS	2	0 09	NS	
	30 — 40	0.09	NS	3	0.09	NS	0.084
	45 — 55	0.08	NS	4	0.09	NS	
	60 — 70	0.08	NS	5	0.08	NS	
Carbonate	0 — 10	1.50	b	1	2.70	a	
	15 — 25	1.90	a	2	2.70	a	
	30 — 40	2.20	a	3	1.90	ab	1.06
	45 — 55	2.20	a	4	2.00	ab	
	60 — 70	2.83	a	5	1.30	b	
Nitrogen	0 — 10	0.051	b	1	0.070	b	
	15 — 25	0.062	a	2	0.034	c	
				3	0.025	d	0.0006
				4	0.037	bc	
	LSD	0.00023		5	0.117	a	

NS—Not significant at P = 0.05

Different letters in the column for each element shows means differing significantly at 5% level of significance.

Table 3

Relationship between the contents of various nutrient elements in plants and soils under Salvadora persica L.

Site	Nutrient elements											
	Calcium		Magnesium		Potassium		Sodium		Phosphorus		Nitrogen	
	In Plant (%)	In Soil (%)	In Plant (%)	In Soil (%)	In Plant (%)	In Soil (%)	In Plant (%)	In Soil (%)	In Plant (%)	In Soil (%)	In Plant (%)	In Soil (%)
1.	7.05	3.52	1.96	4.65	0.70	2.69	4.68	2.55	0.24	0.08	0.31	0 02
2.	6.94	2.06	1.46	2.69	0.74	2.88	4.34	2.83	0.19	0.09	0.40	0.01
3.	7.46	1.90	1.87	2.22	0.84	3.04	5.03	2.35	0.27	0.09	0.32	0·008
4.	8.23	1.97	2.08	2.49	1.12	2.06	5.84	2.36	0.31	0.09	0.43	0.01
5.	7.17	0.96	2.02	2.00	1.04	2 23	4.89	1.64	0.29	0 08	0 39	0.04
Correlation Coefficient (r)	0.17		0.02		0.806		0.30		0.10		0.04	

Soil–Plant Relationship

The foliage of the plant is richer in calcium (6.94 to 7.23%) and sodium (4.34 to 5.84%) indicating the capacity of plant to tolerate salinity. Though the leaves can not be used as fertilizer due to the poor quantities of nitrogen, phosphorus and potassium yet it may be of use in reclaiming the saline soils since a high content of calcium in the litterincreases the amount of exchangeable calcium, reduces soil acidity and stimulates the activity of the soil fauna and flora (Lutz and Chandler, 1946). The analytical data from Table 3 indicates a variability in the chemical composition of individuals growing in plains and depressions as well as those occuring on the plains alone. However, there is no linear relationship between the soil and foliage nutrient concentration of calcium, magnesium, sodium, phosphorus and nitrogen (Table 3). On the other hand, there exists a strong relationship between the soil and leaf potassium which was as high as 81 per cent ($r = 0.806$).

Acknowledgement

The author is thankful to Dr. T.A.T. Wahua of Agronomy Department, University of Ibadan, Nigeria for help in the statistical analysis of data.

SUMMARY

The nutrient content of the leaves of *Salvadora persica* L. of the Indian Thar Desert was studied in relation to its soils. The soils which were mostly light yellowish brown in colour, coarse–sandy in texture and alkaline in reaction contained a meagre amount of organic carbon, nitrogen and phosphorus. The contents of exchangeable calcium and sodium and available phosphorus did not change appreciably with soil depth. The content of different cations in soil varied at different sites but the depressions had comparatively lesser potassium than the sandy plain areas. The same was seen in respect of sodium, calcium and magnesium also. The foliage of the plant is richer in calcium and sodium, with strong positive correlationship (r=0.81) between soil and leaf potassium.

भारत के थार मरु में साल्वेडोरा पर्सिका लि० की पत्तियों और मृदा पोष्याहारों का स्थिति का अध्ययन

लेखक बी०एम० शर्मा

सारांश

इस अभिपत्र में भारत के थार मरु में साल्वेडोरा पर्सिका लि० की पत्तियों के साथ मृदा के सम्बन्ध का अध्ययन किया गया है। मृदाओं में, जो अधिकतर हल्के पीताम भूरे रंग की, स्थूल रेतीली बनावट में, प्रतिक्रिया में क्षारीय थी, कुछ थोड़ी मात्रा में जैव कार्बन, नाइट्रोजन और फास्फोरस था। विनिमेय कैलसियम और सोडियम तथा उपलब्ध फास्फोरस की मात्रा में मृदा गहराई के साथ अधिक परिर्वतन नहीं देखा गया। विभिन्न धनायनों की मात्रा विभिन्न स्थलों की मिट्टियों में देखी गई परन्तु गहराइयों में रेतीले मैदानी क्षेत्रों से भी कम पोटाशियम पाया गया। सोडियम, कैलसियम और मैगनीसियम में भी यही बात पाई गई। इस पादम की पत्तियां कैलशियम और सोडियम में सम्पन्न हैं तथा मृदा और पत्तियों के पोटाशियम में जोरदार घन सम्बन्ध ($\gamma=0.81$) देखा गया है।

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CONTROL OF POWDERY MILDEW DISEASE OF TAMARIND SEEDLINGS

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Introduction

Tamarind (*Tamarindus indica* Linn.) is a well known tree, the pods of which are extensively used for culinary purposes. Various other parts of the tree are used for a variety of purposes. The wood is used for furniture and for other household articles. The bark contains a tannin material. Besides, many parts of the tree are used in medicines. In a forest nursery, most of the one year old tamarind seedlings were found suffering from powdery mildew disease caused by *Oidium* sp. The disease appears as ash coloured powdery growth in small patches on lower surface of the leaves with a slight yellowing on the corresponding upper surface. As the disease advances, these patches enlarge to form thick cottony patches. The leaves turn to yellowish brown colour. All the leaflets are subsequently covered with powdery mass both the sides (Fig. 1 and Fig. 2). In advanced stages defoliation, drying of twigs and die back of seedlings are common (Fig. 3). The defoliation is maximum in the month of June, July and August. In severe cases, seedlings do not recover due to heavy infection. Hence, an attempt was made to protect the seedlings in the forest nurseries through use of chemicals

Material and methods

Easily available Chemicals, Bavistin, Calixin, Karathene, Morestan and Rogor (insecticide) were tested at 0 05 and 0.1 per cent concentrations and sulphur was used as a dust. There were 10 plants for each concentration of the chemical and 10 separate plants served as control. Three sprays were given as per above concentrations at 15 days interval in the forest nursery. The following grades were fixed on the basis of leaflet area covered by the fungus to calculate the disease severity in terms of disease index.

0 — Leaflets free from infection.
1 — 1 to 5 per cent leaflet area affected.
2 — 6 to 20 per cent leaflet area affected.
3 — 21 to 40 per cent leaflet area affected.
4 — 41 to 70 per cent leaflet area affected.
5 — 71 to 100 per cent leaflet area affected.

The percentage disease index was calculated by the formula :

$$\text{Percentage disease index (\% D.I.)} \quad \frac{\text{Sum of numerical values} \times 100}{\text{Number of leaflets graded x maximum rating i.e., 5}}$$

The numerical values were obtained by multiplying the number of leaflets with their respective grading. Observations were taken after 10 days of third spray and results are presented in Table 1.

Results and discussion

The results revealed that sulphur dust was most effective where the disease was completely controlled (Table 1). Karathane and Calixin were effective at 0.1% concentration. Morestan, Rogor and Bavistin were not effective. In control plot, heavy incidence of disease followed by defoliation and drying of seedlings in the field was observed. Karathane and Calixin were more effective at 0.1 per cent level compared to 0.05 per cent. Sulphur dust or Karathane, (0.1%) or Calixin (0.1%) can therefore be used to control this disease at seedling stage. Similar results were noticed in control of powdery mildew of mulberry wherein two sprays of Morestan (0.05%) or Karathane (0.1%) had controlled the disease effectively (Siddaramaiah *et al,* 1977a and 1977b).

Table 1

Effect of different chemicals on powdery mildew of Tamarind in the nursery

Sl. No.	Treatments	Concentrations %	Percentage disease index
1	Control	—	93.20
2	Bavistin	0·05	73.20
		0.10	66.60
3	Calixin	0.05	26.60
		0.10	6.60
4	Karathane	0.05	10.00
		0.10	6.60
5	Morestan	0.05	33.20
		0.10	26.60
6	Rogor	0.05	86.60
		0.10	80.00
7	Sulphur	Dust	00.00

SUMMARY

Five chemicals namely Bavistin, Calixin, Karathene, Morestan, Rogor each at 0.05 and 0.1% concentrations and sulphur as dust, were tested in the forest nursery against powdery mildew of tamarind (*Tamarindus indica* Linn.) caused by *Oidium* sp. These chemicals were applied three times at an interval of 15 days. Sulphur dust was most effective followed by Karathane (0.1%) and Calixin (0.1%). Though the Karathane and Calixin were effective at 0.05% level but disease index was more compared to at 0.1% level. Morestan, Bavistin and Rogor were not effective. The percentage disease indices in sulphur dust, Karathane (0.1%) and Calixin (0.1%) were 0, 6.60 and 6.60 respectively whereas in control plot it was 93.20. Sulphur dust, Karathane and Calixin can be used for controlling powdery mildew disease of tamarind.

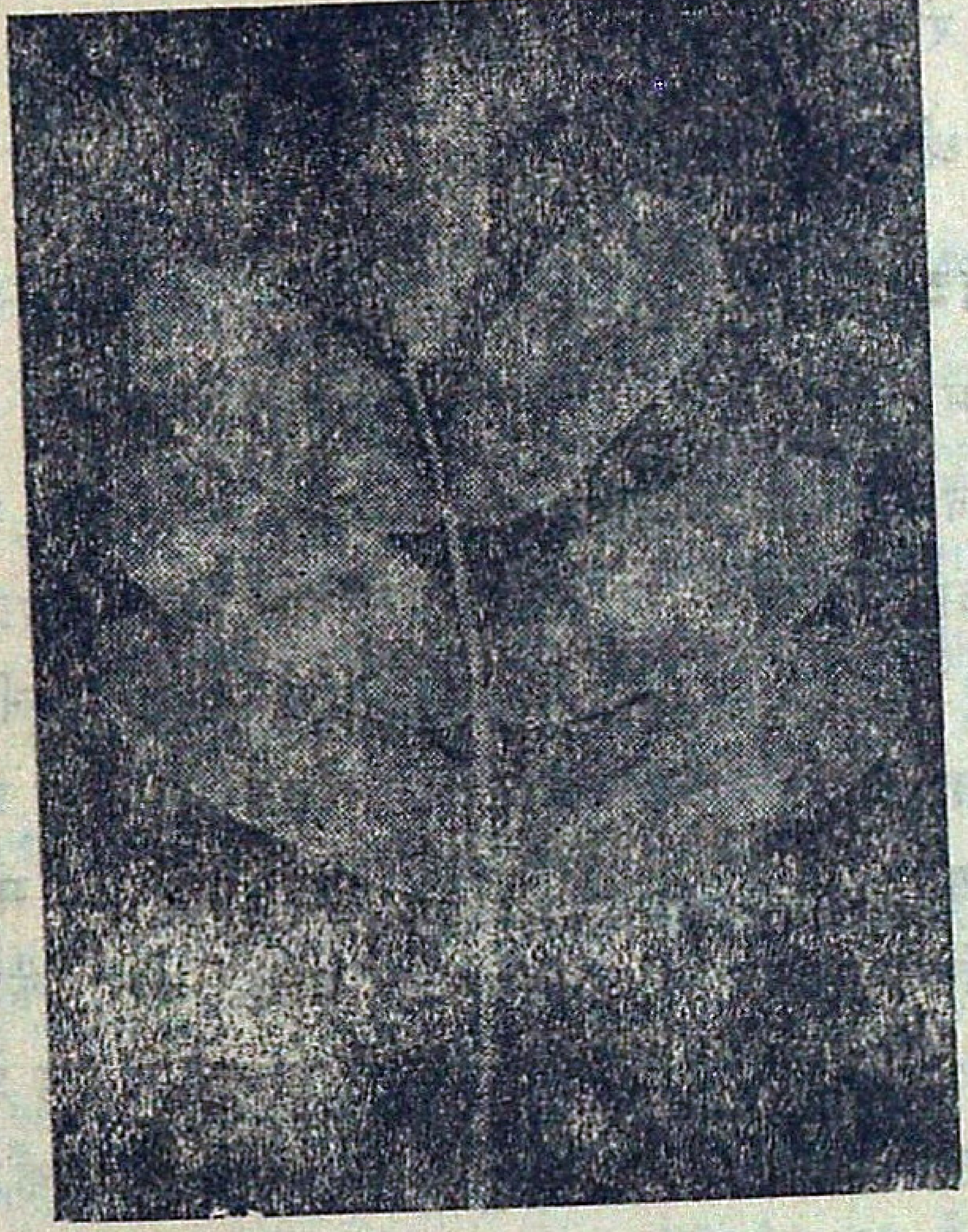

Fig. 1—Initial stage of powdery mildew infection on tamarind seedlings showing powdery growth on the upper surface of leaf-lets.

Fig. 2—Initial stage of powdery mildew infection on tamarind seedlings showing powdery growth on the lower surface of leaf-lets.

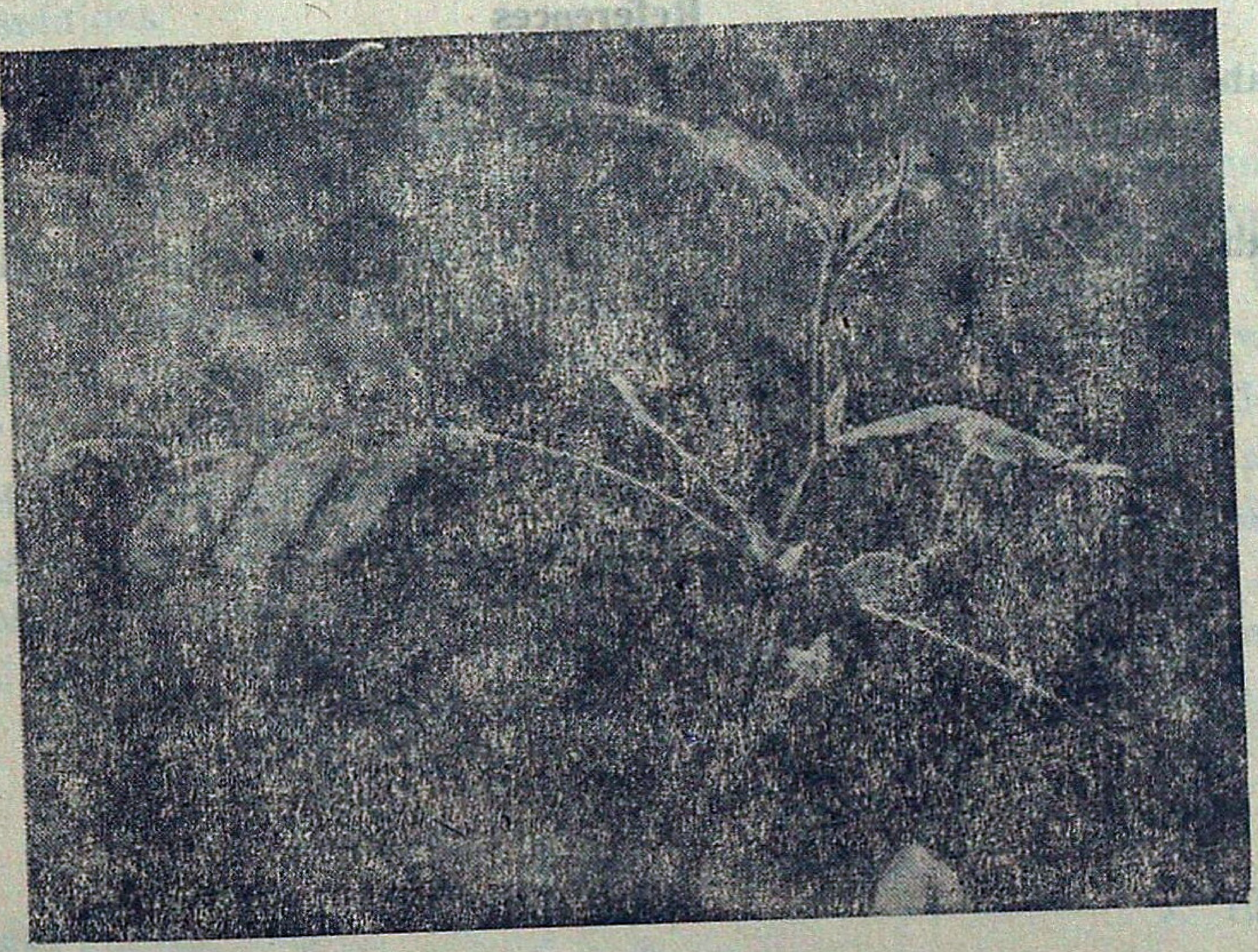

Fig. 3—Advanced stage of powdery mildew infection of tamarind seedlings showing defoliation, drying of twigs and die back of seedlings.

इमली के पौधों के चूर्ण–फफूंद रोग का नियंत्रण

लेखक ए०एन० सिद्धरामैय्या व श्रीकान्त कुलकर्णी

सारांश

इमली (टेमेरिण्डस इण्डिका लि०) के पौधों में आइडियम प्रजा० से होने वाले चूर्ण–फफूंद रोग का वन रोपणियों में नियंत्रण करने के लिए पांच रसायन पदार्थों अर्थात बाविस्टिन, कैलिक्षिण, काराथेन, मोरस्टैन, रोगोर, प्रत्येक को 0.05 और 0.1 प्रतिशत संकेन्द्रण में तथा गंधक को धूलिरूप में लेकर परीक्षित किया गया। ये रसायन पदार्थ 15 दिन का अन्तराल देकर तीन बार प्रयुक्त किए गए। गंधक धूलि सर्वाधिक प्रभावशाली रही इसके बाद काराथेन (0.1 प्रतिशत) और कैलिक्षिन (0.1 प्रतिशत)। कैराथेन और कैलिक्षिन 0.05 प्रतिशत देने पर भी प्रभावशाली निकली परन्तु रोग निर्देशांक 0.1 प्रतिशत की तुलना में अधिक पाया गया। मोरेस्टैन बाविस्टिन और रोगेर प्रभावशाली नहीं रही। गंधक धूलि, काराथेन (0.1 प्रतिशत) और कैलिक्षिन (0.1 प्रतिशत) में रोग प्रतिशत निर्देशांक क्रमशः 0, 6.60 और 6.60 रहे जबकि नियामक भूखण्ड में यह प्रतिशत 93.20 था। इमली के चूर्ण फफूंद रोग का नियन्त्रण करने के लिए गंधक धूलि, काराथेन और कैलिक्षिन उपयोग किए जा सकते हैं।

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The authors are grateful to Dr. R.K. Hegde, Professor and Head of the Department of Plant Pathology, College of Agriculture, Dharwar and Professor S.F. Uppin, Advisor, Farm Forestry Division, Agricultural College, Dharwar, for their help and encouragement.

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ENVIRONMENTAL DESICCATION AND SEEDLING SURVIVAL IN *CASSIA* SPP.

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Introduction

In environments, where conditions for seedlings are uncongenial after germination, their survival depends on the imposed stress. The survival of seedlings in hot and dry climates can be analysed in terms of field resistance to drought (Levitt, 1972). Besides the direct danger of permanent leaf damage caused by the excessive loss of water from chlorotic leaves, a number of other harmful effects are likely to be produced (Hutchinson, 1970; El–Sharkawy and Hesketh, 1964; Allerup, 1958).

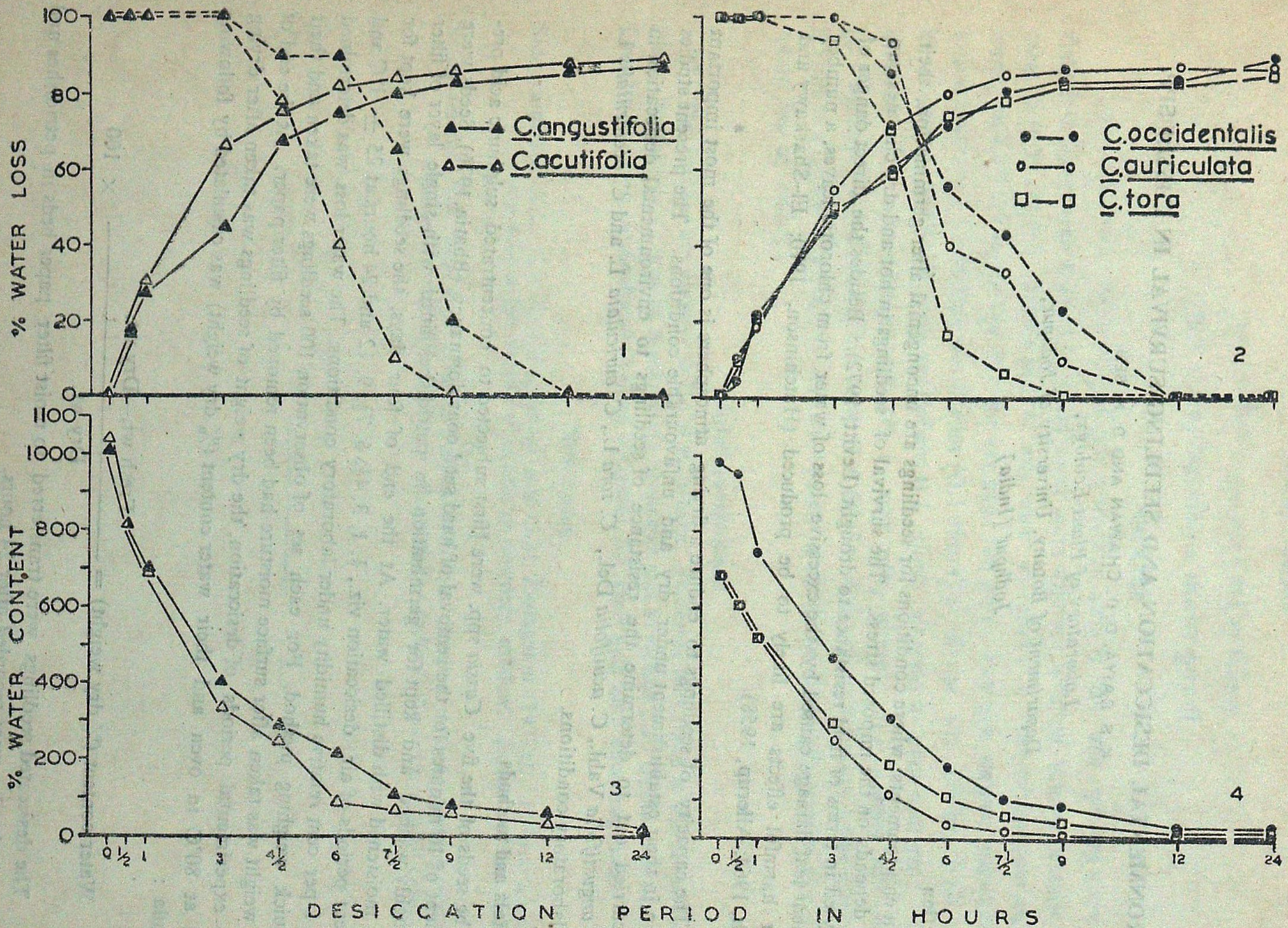
The capacity of seedlings to endure a drying atmosphere is one of the most important criterion in their establishment under dry and unfavourable conditions. The present studies were carried out to determine the resistance of seedlings to environmental desiccation in *Cassia angustifolia* Vahl., *C. acutifolia* Del., *C. tora* L., *C. auriculata* L. and *C. occidentalis* L. under laboratory conditions.

Materials and methods

The seeds of the five *Cassia* spp. were first subjected to concentrated sulphuric acid pre-treatment of 10 minutes for the removal of hard seed coat dormancy (Bhatia, 1976). Seeds were thoroughly washed and kept for germination in petridishes lined with single layer of filter paper moistened with distilled water. At the end of four days, the seedlings were kept for different periods of air desiccation viz., $\frac{1}{2}$, 1, 3, $4\frac{1}{2}$, 6, $7\frac{1}{2}$, 9, 12 and 24 hours at 25 $\pm$ 1°C and 53 $\pm$ 2 per cent relative humidity under laboratory conditions. The water loss was determined by quick weighing method. For each set of observation 100 seedlings were taken and their fresh weight was taken after surface moisture had been removed by filter paper. At the end of these experimental periods of desiccation, the dry weight of seedlings was taken after drying them at 80°C in oven and their water content (% dry weight) was calculated by following formula :

$$\text{Water content (\% dry weight)} = \frac{\text{Fresh wt.—Dry wt.}}{\text{Dry wt.}} \times 100$$

The desiccated seedlings were transferred to moist filter paper beds in petridishes and their survival value were recorded after 24 hours.



Figs. 1–2 Percentage water loss (continuous line and survival (dotted line) in *C. angustifolia, C. acutifolia, C. occidentalis, C. auriculata* and *C. tora,* when subjected to desiccation at different intervals of time (h).

Figs. 3–4 Percentage water content (on dry weight basis) in *C. angustifolia, C. acutifolia, C. occidentalis, C. auriculata* and *C. tora,* when subjected to desiccation at different intervals of time (h).

Results and discussion

The results obtained for water loss, seedling survival and water content are shown in Figs. 1-2 and 3-4, respectively.

It is evident from Figs. 1 & 2 that in all *Cassia* spp. the water loss increased rapidly upto 3 h but afterwards it was gradual. The maximum water loss was observed in *C. acutifolia* (△—△), followed by *C. auriculata* (○—○), *C. tora* (□—□), *C. occidentalis* (○—○) and *C. angustifolia* (▲—▲) after 4½ h of desiccation. The values of water loss were found to be nearly same after the desiccation for 24 h.

It is clear from Figs. 3 & 4 that the maximum water content was observed in *C. acutifolia* (1044.7) followed by *C. angustifolia* (1014.7), *C occidentalis* (989.0) *C. tora* (691.4), and *C. auriculata* (689.6). The water content decreased rapidly after 4½ h of desiccation and after that it decreased slowly in all the species. The water content was more in *C. occidentalis* (315.2) followed by *C. angustifolia* (285.6), *C. tora* (192.8), and *C. auriculata* (119.1) after 4½ h of desication, but after this period maximum water content was observed in *C. angustifolia* at all desiccation periods.

A cent per cent survival was observed in all *Cassia* spp. upto 3 h of desiccation except in *C. tora*, where it was 93.3%. The survival per cent went down rapidly upto 6 h desiccation in all species except in *C. angustifolia*, where it was still 90% followed by *C, occidentalis* (55.5%) *C. acutifolia* (40.0%), *C. auriculata* (39.8%) and *C. tora* (16.6%). The survival percentage was found to be zero in *C. tora* and *C, acutifolia* after 9 h of desiccation, whereas it was 23.3% in *C. occidentalis*, 20 0% in *C. angustifolia* and 9.9% in *C. auriculata*. No survival of seedlings at a desiccation period of 12 h or above was observed.

It can be concluded from above that water loss is inversely proportional to water content, and as the desiccation period is prolonged, the percentage of survival gets reduced. The wider divergences between the curves of water loss and water content for desiccation, indicate differences in seedling tissue resistance to water in all these species studied; *C. angustifolia* shows highest resistance.

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SUMMARY

***C. angustifolia*, which could tolerate a complete drying for 6 h was found most resistant to desiccation among the five *Cassia* spp. This shows that this species should be suitable for large scale cultivation in deserts as it is very resistant to drought.**

पर्यावरण सुखाव और कैसिया जातियों में पौधों की अतिजीविता

लेखक के०एस० दैया, डी०डी० चव्बाण व डी०एन० सेन

सारांश

कैमिया की पांच जातियों में से कै० अंगुस्टिफोलिया जो छह महीने तक पूरी तरह शुष्कन होना सह लेती है। सूखे के प्रति सबसे अधिक प्रतिरोधी पाई गई इससे पता चलता है कि मरु भूमियों में बड़े परिमाण पर लगाने के लिए यह पादम जाति उपयुक्त रहेगी क्योंकि यह बहुत अधिक शुष्कता प्रतिरोधी है।

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STORAGE STUDIES ON KATTHA

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Introduction

Kattha and cutch are obtained from the water extract of the heartwood of *Acacia catechu* Willd fam. Leguminosae, called khair in Hindi. The manufacture of kattha and cutch is carried out on both small and large scale. They are separated from the aqueous extract by making use of the difference in their solubility in water, in which kattha is less soluble than cutch. Kattha is extensively used for chewing with betel leaf; is also used in medicine. Cutch, a by-product of kattha industry, is mainly used for non-edible purposes, in tanning leather, deep oil well drilling and for descaling boiler deposits.

Kattha predominantly consists of a mixture of catechin isomers, while cutch is composed of catechu-tannic acid polymers. Catechin easily changes into catechu-tannic acid and/or similar substances on decomposition, but this change is not reversible. Heat and moisture injure and decompose catechin. Once, however, the catechin is separated and dried, it remains unchanged for long years. It has, however, been observed that cream/light brown coloured kattha tablets get blackened on storage, especially at the surface exposed to light. To avoid blackening Kattha tablets are dried under shade, as sun drying is injurious to catechin causing decomposition, and finally in an air-oven at about 40°C. This process of drying has not only reduced the drying time but has also minimised the chances of fungal attack and serious discolouration.

The market price of kattha depends to a certain extent on its colour. Kattha of lighter colour fetches more price as compared to dark coloured. It was, therefore, considered worthwhile to investigate the effect of different external and internal agents on the storage of kattha. The investigation was also prompted by the requests of certain small scale kattha manufacturers who faced the problem of colouration of kattha on storage.

Experimental

Two samples of kattha were separately prepared from the heartwood of *Acacia catechu* trees growing in New Forest Estate of F.R.I. & Colleges, Dehra Dun. One sample (B) before drying was further purified by suspension in cold water, filtered to remove the soluble cutch extract and then dried. Unpurified kattha was designated as sample A. Samples A and B of Kattha were analysed according to Indian Standard Specification IS : 2962-1964 (Methods of sampling and test for Kattha) and their characteristics are given in Table 1. The requirements of Grade I kattha according to IS : 4359-1967 (Specification for kattha) are also reported in Table 1.

Table 1

Statement regarding characteristics of Kattha samples

Sl. No.	Characteristics	Sample A	Sample B	Requirements of Grade I Kattha (IS : 4359-1967)
1.	Loss on drying, per cent by weight	6.6	6.7	Max 12
2.	Catechin content, per cent by weight	67.5	70.8	Min 55
3.	Matter insoluble in rectified spirit, percent by weight	6.31	5.5	Max 25
4.	Insoluble in boiling water, per cent by weight	4.5	4.0	Max 3
5.	Total ash, per cent by weight	1.3	1.0	Max 1.3
6.	Acid insoluble ash, per cent by weight	0.06	0.05	Max 0 2

Both the samples of kattha were powdered and stored under different conditions, *i.e.* in the open, colourless, brown and black coloured bottles. Another set of these bottles containing kattha were kept in a dessicator filled with nitrogen gas. Colour of kattha samples were taken using Lovibond Tintometer in yellow and red, initially at the beginning, after week's, fortnight's, month's intervals and continued for period of one year. The results are reported in Table 2 (See pp. 373–4).

The above samples were also analysed by paper chromatography on Whatmann No. 1 filter paper with n-butanol : acetic acid : water (4 : 1 : 5) as the developing solvent. After development, paper was dried and spots viewed under ultra-violet light. Two spots of hf value 0.56 (sparse) and 0.66 (dense) were observed in all the samples. Specific rotation in methanol was determined in each case and was found to be the same, viz. –28.0° and –24.0° for samples A and B, respectively, throughout the investigation

Discussion

The sample A with 67.5 per cent catechin content had a colour reading of Y, 1.0 and R, 1.5 in the beginning. After a week's storage this sample kept in the open had a colour of Y, 1.2 and R, 1.6, while those stored in bottles under air gave a colour of Y, 1.1 and R, 1.5 and those stored under nitrogen gave a colour of Y, 1.0 and R, 1.5. After a lapse of one year colour readings of sample A stored under different conditions were almost the same as after a period of one week. Sample B with 70 8 per cent catechin content had an intitial colour reading of Y, 1.0 and R, 1.3. Even after a lapse of one year there was no change in the colour reading under different conditions of storage. The Rf values and specific rotation of all the samples stored under different condition were the same in the beginning and after a storage period of one year indicating no chemical change in the dried samples.

Conclusion

There is a slight change of colour in kattha sample A in a week's time and after that no change was observed on storage for a period of one year. In sample B, there is no change in colour. It contains lesser amounts of cutch, as compared to sample A, indicating that the colour change in kattha on storage may be mainly due to the presence of cutch and probably of moisture. If these are eliminated then the original colour of kattha can be retained over prolonged storage. There is no effect of light on a purer sample (B) of kattha. This investigation indicates that diffused light does not affect the colour or composition of dry kattha having lesser amounts of cutch.

Acknowledgement

Thanks of the authors are due to Shri R. N. Kaul, Director Forestry Research and Dr. K. S. Ayyar, Officer-in-Charge, C. F. P. Branch, for their keen interest shown during the course of investigation.

SUMMARY

Storage studies on two sample of kattha having 67.5 and 70.8 per cent of catechin were made under different storage conditions for a period of one year. The studies indicate that diffused light does not affect the colour or composition of dry samples of kattha having lesser amounts of cutch.

कत्थे का भण्डारण अध्ययन

लेखक आर०एम० बेरी व एन०पी० डोभाल

सारांश

भण्डारण की भिन्न-भिन्न दशाओं में एक वर्ष तक रखकर 67.5 प्रतिशत और 70.8 प्रतिशत कैटेचिन (खदिरि) तत्व वाले कत्थे के दो नमून का भण्डारण अध्ययन किया गया। इस अध्ययन से पता चला है कि प्रसृत प्रकाश से कत्थे के सूखे जमूनों में, जिनमें कच की मात्रा कम हो, उनके रंग या गठन पर कोई कुप्रभाव नहीं पड़ता।

Table

Lovibond Tintometer colour readings in yellow and red of

Date of observation	Sample A						
	Open	Under air bottles			Under nitrogen in bottles		
		Colour-less	Brown	Black	Colour-less	Brown	Black
1	2	3	4	5	6	7	8
12.8.80	1.0, 1.5	—	—	—	—	—	—
20.8.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0 1 5	1 0, 1.5	1.0, 1 5
28.8.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5	1.0, 1.5
19.9.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5	1.0, 1.5
7.10.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1 0, 1.5	1.0, 1.5
21.10.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5	1.0, 1 5
17.11.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5	1 0, 1.5
17.12.80	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5
22.1 81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5
18.2.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0 1.5	1.0, 1.5
17.3.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5
20.4.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1,0, 1.5
20.5.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5
22 6.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5
21.7.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5
21,8.81	1.2, 1.6	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.1, 1.5	1.0, 1.5	1.0, 1.5

2

kattha samples stored under different conditions after varying periods

Samples B						
	Under air in bottles			Under nitrogen in bottles		
Open	Colour-less	Brown	Black	Colour-less	Brown	Black
9	10	11	12	13	14	15
1.0, 1.3	—	—	—	—	—	—
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3
1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3	1.0, 1.3

A NEW COMBINATION IN *OXYGRAPHIS* BUNGE (RANUNCULACEAE)

S. S. R. BENNET AND SUMER CHANDRA

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Directorate of Biological Research,

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The name of the Himalayan species *Oxygraphis polypetala* Hook. f & Thoms. is a combination based on *Ranunculus polypetalus* D Dun (1834) which is a later homonym of *Ranunculus polypetalus* Raf. (1817). Therefore, the date of priority of *Oxygraphis polypetala* Hook. f. & Thoms. is actually 1855 and not 1834. As the name *Callianthemum endlicheri* Walp. (1842) has priority over *Oxygraphis polypetala* Hook. f. & Thoms. the following new combination is necessary for this species :

Oxygraphis endlicheri (Walp.) Bennet & Chandra *comb. nov.*

Callianthemum endlicheri Walp. Rep. 1 : 33. 1842.

Ranunculus polypetalus D. Don in Royle, Ill. 54. 1834, *non* Raf. 1817.

Oxygraphis polypetala Hook. f. & Thoms., Fl. Ind. 27. 1855 & Fl. Brit. Ind. 1 : 21. 1872; Mukerjee in Bull. Bot. Surv. Ind. 2 : 105. 1960; Banerji in Rec. Bot. Surv. Ind. 19 (2) : 19. 1965.

SUMMARY

The correct name of *Oxygraphis polypetala* Hook. f. & Thoms. is *Oxygraphis endlicheri* (Walp.) Bennet & Chandra.

आक्सिग्राफिस बुंगे (रैननकुलेसी=नवनीतचष कुल) का एक नया संयोग

लेखक एस०एस०आर० बेनेट व सुमेर चन्द्र

सारांश

आक्सिग्राफिस पोलिपिटेला हुक० वत्स व थाम्स० का सही नाम आक्सिग्राफिस एंड्लिशरी (वाल्प०) बैनेट व चन्द्र है ।

RESEARCH NOTES

(I)

FIRE ANT, *(SOLENOPSIS SP.)* DAMAGING NEEM *(AZADIRACHTA INDICA* JUSS.)

In the month of May, (1978) heavy incidence of Fire-ants was observed on the 3–6 year old Neem plants around Rajenderanagar area of Hyderabad, Andhra Pradesh.

Thousands of ants were found feeding voraciously on the leaves, leaving behind the petiole and mid-rib of leaves, thus completely defoliating the plants. Young rachis were also attacked due to their infestations in severe cases. The ant attack was confined only to neem trees though there were many wild shrubs present in the vicinity. There are no earlier reports of the fire-ant attack on neem trees in Andhra Pradesh.

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Hyderabad–500030

1. T.A.V.S. Raghunath
2. Mohd. Abdul Allam
3. K. Venkaiah

(II)

FURTHER NOTES ON THE BIRTH OF HYBRID MACAQUE *MACACA RADIATA* × *MACACA ASSAMENSIS* AT NANDANKANAN BIOLOGICAL PARK, ORISSA

Acharjyo and Misra (1976) reported the birth of one male hybrid macaque of a female Assamese Macaque *(Macaca assamensis)* and a male Bonnet Macaque (*Macaca radiata)* for the first time at Nandankanan Biological Park, Orissa on 9.3.1975. Another female hybrid macaque was born of the same pair of female Assamese Macaque and male Bonnet Macaque on 27.3.1977, after an inter-parturition interval of 2 years and 17 days at the Nandankanan Biological Park.

Like the earlier male hybrid, the colour of the body coat of this female hybrid young also resembled that of the mother whereas the shape of the ears, the length and shape of the tail and crown hair on the head resembled that of the father.

Both the hybrid macaques along with their mother Assamese macaque are doing well. Such a hybrid macaque has not been reported by Gray (1972).

Veterinary Asstt. Surgeon, L.N. Acharjyo
Nandankanan Biological Park,
P.O. Barang (Cuttack). and

Wild Life Conservation Officer, Orissa, Ch. G. Misra
95-Sahid Nagar, Bhubaneswar-751007.

References

Acharjyo, L.N. and R. Misra (1976) : Notes on a Young Hybrid Macaque, *J. Bombay nat. Hist. Soc.* 73 (3) : 521-522.

Gray, A.P. (1972). Mammalian Hybrids, Commonwealth Agricultural Bureaux, Farnham Royal, Slough, England.

LETTERS TO THE EDITOR

1)

To

The Honorary Editor,
Indian Forester,
P.O. New Forest, Dehra Dun.

Sir,

The author of the article "Logging Waste—A Potential Source of Energy" published in *Indian Forester* of December 1981 has calculated that energy equivalent of 8¼ Bhakra-Nagal Dams could be saved by improvements in billeting firewood, sawing and extending exploitation to remote forests areas classed as potentially exploitable.

The saving is indicated as under :

Logging activity	Saving of firewood in million m^3	Energy equivalent in megawatt hours of electricity	Number of Bhakra-dam equivalent
1. Billeting firewood by bow saw or crops cut saw instead of axe.	18.0	7042	6
2. In-situ conversion	0.4	31	—
3. Exploitation of forests classed as potentially exploitable.	6.9	2720	2¼
Total	25.3	9793	8¼

This enormous energy potential in salvaging logging waste as claimed by the author, is bound to attract the larger attention and will need thorough study and analysis. However, the following lines will throw some light on the matter.

First of all, the assesment made by the author that at least 12% extra fuelwood will be available by using saw instead of axe in billeting of firewood appears an exaggeration for two reasons :

1. A length of 10 to 25 cm is not lost on each firewood billet 75–90 cm long by axe cutting. The width of axe cut will depend on the diameter of the stem to be cut. A piece of 5 to 8 cm diameter, which is usually the size of firewood removed by the villagers from forests as unrecorded annual firewood production, will be cut into pieces in one or two strokes by axe, sometimes even without loosing a piece of wood in the form of chips. In bigger size stems the width of axe cut will be wider, the cuts is in conical shape and full volume over the length of the cut is not lost. The width of the axe cut will also be much less than 10 to 25 cm in most of the cases as, majority of firewood stems are in small diameters. The estimate of 18 million m^3 of firewood saving will come down drastically for this reason.

2. The entire fuelwood in the country is not cut with axe only. All over the foot-hills in North India and many other places, in the felling coupes of Forest Corporations or private contractors, saw is mostly used for billeting of firewood stems of bigger dimensions, say over 10–15 cm diameter except in some instances where combination of saw and axe or axe alone is used.

Secondly, the author's assesment that 80% of annual out turn of coniferous timber (1.7 million m^3) is is extracted after *in situ* conversion is also not reasonably correct. It Kashmir valley and parts of Jammu, Himachal and U.P., quite a large proportion of coniferous timber is removed in log form or sawn in the forest by diesel operated band saws. The wood chips of *in-situ* conversion are collected by the villagers for firewood. Thus the net wastage as such, or saving of firewood for energy generation in terms of Bhakra equivalent will be only negligible.

Thirdly, the forests now classed potentially exploitable will not produce proportionately the same amount of timber and firewood as the exploitable forests because such forests are not only in the remote areas but these are poorly stocked and annual removal after meeting local needs of firewood, as at present, will be much less.

Yours faithfully,

Sd./– B.P. Maleta
Officer-in-Charge,
Logging Branch,
F.R.I & Colleges, Dehra Dun.

Dated 20.1.1982

(II)

To

The Honorary Editor,
Indian Forester,
P.O. New Forest, Dehra Dun.

Sub :– **Facts based on personal observation.**

Sir,

It is conventionally said that Tree Fern blocks act as a good perch for epiphytic orchids as a result Tree Fern species are depleting. In Sikkim two species of Tree Fern are generally noticed viz. *Cyathea brunoniana* Clarke & Baker and *C. spinulosa* Wall. ex Hook. The forest floor is being cleared of by cutting these by horticulturalist & others for making blocks and tyeing Orchids. But in nature no where it has been seen that epiphytic orchids grow on them. This wrong notion should be wiped out. This not only will give a chance for their survival rather save them from total destruction.

Your's faithfully,
Sd.–/ B Krishna
Botanical Survey of India,
Gangtok

(III)

To
The Honorary Editor,
Indian Forester,
P.O. New Forest, Dehra Dun.

Subject :—**Forest Conservation in Khasi and Jaintia Hills.**

Sir,

Some issues of the *'Indian Forester'* have always interested me—despite the fact that my knowledge in the subject is very meagre. What I would like to say is merely this : that the forest resources of Assam, Arunachal, Nagaland, Mizoram and Meghalaya are dwindling very fast. I have had the good luck to have penetrated deep into the interior of these States in the course of my labour. That the authorities who wrote about the variegated botanical species existing in the north-eastern region knew what they were talking about is a fact that no one will dispute.

It is hoped though that it could help the forest experts and flora investigators if some pertinent facts concerning natural vegetation in Khasi and Jaintia Hills, excluding those dealing with ferns, flowers, orchids and rhododendrons, are made acquainted with, both for the purpose of public interest and scientific pursuit.

It might interest you to know that only in one sacred groove at Mawphlang village, in Khasi Hills, there used to be about 112 species of hardwood trees included among which are *Camelia caduca, Polygala arillata, Brucea moli, Itex vernulosa, Ficus nerlifolia.* Of them about 30 species have become extinct. In Khasi and Jaintia Hills the number of hardwood trees is around 300-apart from the few species planted at the Botanical garden, Shillong. Number the number of live species has decreased astronomically. That the forest research scientists have devoted their time and energy to conservation of our forest resources is very much appreciated. But mere dry statistics, it is feared, will not solve the problem.

Your's faithfully,
Sd./- U. Carsley Lyngdoh
St. Joseph's Road, Jaiaw Laitdom,
Shillong-793 002

1st May, 1982

(IV)

To,
The Honorary Editor,
Indian Forester,
P.O. New Forest, Dehra Dun.

Subject :—**Natural regeneration in** *Diospyros melanoxylon* **Roxb. (Bidi Plant)**

Sir,

D. melanoxylon is a tree of high economic importance as its leaves are used as wrapper of country cigar known as 'Bidi' hence gives a large revenue to the state Government as provides substantial opportunities of employment to a multitude of tribals and other weaker sections of the society.

It this particular species, natural regeneration by seedlings seemed to be lacking because of the conditions unsuitable for the establishment of seedlings on forest floor. However, regeneration by root suckers was found to be plentiful because no any other Indian tree species surpasses *D. melanoxylon* in the profusion, hardiness and tenacity of its sucker reproduction.

During the present study distribution/sprouting of root suckers in relation to site and topography was observed at eight heterogeneous sites of tropical dry deciduous forests of Sagar, Madhya Pradesh.

At all sites sucker-generated plants were seen in the form of clums and the percentage of these was more (79.49%) in comparison to those of solitary trees (20.51%). The sucker generated plants were more abundant in open forests with sparse canopy of trees than in dense forests. There were great variations too in number, morphological structure, sprouting and mode of penetration of suckers under different topographic situations. Mostly sunfacing slopes had greater number (860/ha) of sucker generated plants than plateaux (800/ha) and hill base (636/ha).

The present study reveals that the sunfacing slopes of biotically disturbed and open forests are best media for enhancement of natural regeneration by growing root suckers. After proper care and management of these sucker-generated population the new crop of bidi leaves may be annually harvested for the manufacture of bidis.

Yours Sincerely,

Sd./- Dr. C. D. Athaya
Research Associate
Department of Botany,
University of Saugar, Sagar (M.P.) 470 003

REVIEWS

(I)

Ferns and Fern-Allies of Meghalaya State, India by A.K. Baishya and R.R. Rao, Scientific Publishers, Jodhpur, pp. 1-161. Price : Rs. 100 or US $ 20.00

The book deals with the Pteridophytic flora of a Phytogeographically important region in Eastern India. The geographical limits are confined to the Garo, Khasi and Jaintia Hills falling in Meghalaya State which earlier constituted part of Assam region. In all, 244 species (also 14 varieties) are dealt with. These include 32 forallice and the rest are all ferns. The arrangements of families is according to R.E. Holttum's (Biol. Rev. 24 : 267–296. 1949) system of fern classification because of author's familarity with it and for no other reason. After giving a brief history of systematic botany in the region, the authors have appended notes on physiography, geology, soils and climate of the region. There is a general account of the vegetation and fairly comprehensive notes on ecology of the ferns and fern-allies. There are supported by some interesting photographs. Dichotomous keys are provided for the separation of families, genera and species. Abridged descriptions follow for each taxon dealt with. These are supported by sketches for habit, venation, scales, sori etc. for quite a many fern species. Comprehensive index to family, generic and specific names completes the work.

By and large, the latest nomenclature is used by the authors and for each specific name information is appended for basinyms and very frequently used synonym with reference to R.H. Beddome's book "Handbook to the Ferns of British India, Ceylon and Malaya Peninsula" and C.B. Clarke's work on "Ferns of Northern India".

Presently, one would not agree with the author's using R.E. Holttum's classification which was published 23 years ago and when in the interim period better workable arrangements were proposed. Two of these are by Crabe *et al* (Fern Gad. 11 : 141–142, 1975) and Pichi Sermolli (Webbia 31 : 313–512, 1977). Even Holttum (Flora Malasiana) revised his earlier system. But it is gratifying to note that the latest delimitation of genera of Thelypteridaceae is based on R.E. Holttum's work whose note is considered the world authority on the taxonomy of this group of ferns. I have applied the keys and these work well. By and large the production values are good (the authors themselves having given the errata and corrigenda) although better quality paper should have been used particularly for the pr ce fixed for the book.

The book should be a boon to the students of taxonomy in the eastern region of India. It should also be equally useful to the research workers in this discipline of botany. Further, the book is a very welcome addition to the taxonomic literature.

M. B. Raizada

(II)

Methew, K.M. (1981)—*Materials for a Flora of the Tamilnadu Carnatic*. **The Rapinat Herbarium, St. Joseph's College, Tiruchirapalli-620 002, India. 25×17×3 cm, pp X + 469 with 2 maps and 20 black and white photographs. Price Rs. 100 or £ 15 or $ 40.**

The book aims to provide a complete check-list of Plants of the Tamilnadu Carnatic. This precursory volume is the first of the envisaged three volumes. The second volume dealing with detailed descriptions of 2260 taxa and the third one depicting 1000 illustrations, representing one species each from the included genera, are announced for late 1982. The pre sent work is the result of "sweating proposition of 18 hours a day" by the author and his colleagues, as the author himself puts it.

The volume is divided into three chapters.

Chapter one : "The project", subdivided into 15 parts, gives a readable account of geographical, physical, geological and botanical aspects of the Tamilnadu Carnatic. Previous explorations (with documentation of collection and respective collectors with acronyms of herbaria where the specimens are housed), present exploration (from initial stage to the final stage), field trip reports, etc. have been dealt with in pretty good length. Topics like Ethnobotany and Conservation have also been touched upon. This chapter is illustrated with black and white photographs bearing catchy captions but none of them is numbered as shown in the contents'. The author, it seems, has made every possible effort to put each and every thing he did in the project in black and white. The 14th part of this chapter according to the author is a "truncated list of what was to be a comprehensive bibliography for the region" but one may not fail to find some irrelevant references of far flung areas such as Kurseong (Darjeeling District). This chapter, though important as it is, has probably exceeded the desired length.

Chapter two : Documentation of herbarium specimens is the main feature of this chapter. List of abreviations of the author's names is useful. A total of 2376 taxa of Angiosperms, Pteridophytes and Gymnosperms is listed. Families of Angiosperms are arranged according to the Bentham and Hooker's system with some modifications. Genera, species and varieties are in alphebatical order, strictly after Gamble and Fischer's *Flora of the Presidency of Madras*. There is no denying the fact that the present work has emanated as a result of extensive and intensive exploration of the tract in question. Every binomial is appended with citation of district-wise representative collection against the acronyma of the respective her baria. *Fl. Madras* has been taken as an unambiguous frame of reference; it will, therefore, not be unjust and out of place to say that this volume presents a complete and up-dated check-list of Gamble and Fischer's work as far as the Present tract is concerned. Plants not recorded in

Fl. Madras have been marked with an asterisk. Keys, synonymy, descriptions, etc. have not been given. All the names used in *Fl. Madras* have been taken as such, most of which have now become out of date and need to be replaced by new names as per provisions of the International Code of Botanical Nomenclature; it has been deliberately done so by the author who, however, gives latest names in case of plants which are additions to Gamble and Fischer's work. In a work of this kind it is very difficult to comment on the nomenclature, as it cannot be ascertained whether the author has used a given nomenclature with cognisance or incognisance of divergent recent treatments of the same taxon. Volume 2 will perhaps be a work to measure on such a yard stick.

Chapter Three : It gives an illustrated description of "the base of work". It starts with the emblem of the Rapinat Herbarium. The author has discussed the historical past and has given a detailed list of books (in the library) along with the current programmes, outlook for future, publications, etc. The relevance of this chapter is not clearly understood.

The proof-reading which throughout the volume is of an excellent standard has suffered some mistakes e.g. *Chukrassia* and *Limnophylla* for *Chukrasia* and *Limnophyla* respectively on p. 26, *Ipomoea pes-carpae* Sweet (1122) appears as *Ipomea pes-carpae* Sweet, *Lycopersicum esculentum* Miller (1159) as *Lycopericum esculentum* Miller, *Gomphrena celosioides* Martius (1476) as *Gomphrena celsioides* Martius, *Coelogyne breviscapa* Lindley (1746) as *Coclogyne breviscapa* Lindey and *Chlorophytum laxum* R. Br. (1848) as *Chlorophytun laxum* R. Br. Printing and type setting are excellent except for a very few lapses. Binding of the volume is, however, not up to the mark.

Though the book is a Catalogue and not a Flora, on the whole it should prove to be quite useful and the botanists interested in the vegetation of Tamilnadu Carnatic should be grateful to Fr. Mathew for his untiring effort.

K. N. Bahadur

GAZETTE NOTIFICATIONS

F.R.I. GAZETTE

The President, Forest Research Institute and Colleges, D. Dun has been pleased to permit Shri Bharat Singh Bist, Research Officer, F.R.I. & Colleges to retire from service, on attaining the age of superannuation, on 30.4.82 (AN).

Shri S.N. Dass, Research Officer, Forest Soil-cum-Vegetation Survey, Midnapore Centre has resigned from his post with effect from the afternoon of 24th May, 1982.

On his request the services of Shri Padam Sain, Accounts Officer, Forest Research Institute and Colleges, Dehra Dun have been replaced at the disposal of the Controller General of Defence Accounts, New Delhi with effect from 17.5.1982 (AN).

The President, F.R.I. & Colleges has been pleased to accept the resignation tendered by Dr. Rajesh Pant, Research Officer of his appointment at F.R.I. & Colleges, Dehra Dun w.e.f. 11.11.1980 (A.N.).

KARNATAKA GAZETTE

On return from Study Leave Shri S. Parameshwarappa, IFS, is appointed with immediate effect and until further orders as Conservator of Forests, Research and Utilisation Circle, Bangalore.

Shri S.C. Thippeswamy, IFS, on return from leave, is appointed with immediate effect and until further orders as Additional Chief Conservator of Forests, Working Plan and Development Circle, Bangalore Shri *vice* D.K. Deshmukh, IFS, proceeding on leave.

WEST BENGAL GAZETTE

The Governor is pleased to appoint the following Officers, until further orders :–

1. Shri R. Sinha, IFS (on probation), on return from his Soil Conservation training at Dehra Dun, as Attached Officer, Panchet Soil Conservation Division with effect from the date of his assuming charge.

2. Shri S.S. Bist, IFS (on probation), Attached Officer, Cooch Behar Divn. as Attached Officer, Bankura (North) Division with effect from the date of his assuming charge.

3. Shri P. Sen Gupta, IFS (on probation), Divisional Forest Officer, Cultural Operation Division as Divisional Forest Officer, Implementation and Evaluation Cell with effect from the date of his assuming charge *vice* Shri A.R. Chakraborty, W.B.S.F.S., transferred.

4. Shri A R. Chakraborty, W.B.S.F.S., Divisional Forest Officer, Implementation and Evaluation Cell as Divisional Forest Officer, Cultural Operation Division with effect from the date of his assuming charge *vice* Shri P. Sen Gupta, IFS (on probation) transferred.

5. Shri R. Sinha, IFS (on probation), attached officer, Silvicultural Division (South) as Attached Officer, Panchet Soil Conservation Division with effect from the date of his assuming charge.

6. Shri S.J. Barman, W.B.S.F.S., Divisional Forest Officer, Nadia-Murshidabad Division, as Forest Economist with effect from the date of his assuming charge.

7. Shri S.S. Bist, IFS, now holding a junior scale post attached to Bankura (North) Division, as Divisional Forest Officer, Nadia-Murshidabad Division with effect from the date of his assuming charge *vice* Shri S.J. Barman, W.B.S F.S., transferred.

8. Shri K. Chakraborty, W.B.S.F.S., Divisional Forest Officer, Birbhum Division, as Divisional Forest Officer, Planning and Statistics (Statistics) with effect from the date of his assuming charge.

9. Shri U. Das Gupta, W.B.S.F.S., Divisional Forest Officer, Buxa Division, as Divisional Forest Officer, Birbhum Division, with effect from the date of his assuming charge *vice* Shri K Chakraborty, W.B.S.F.S., transferred.

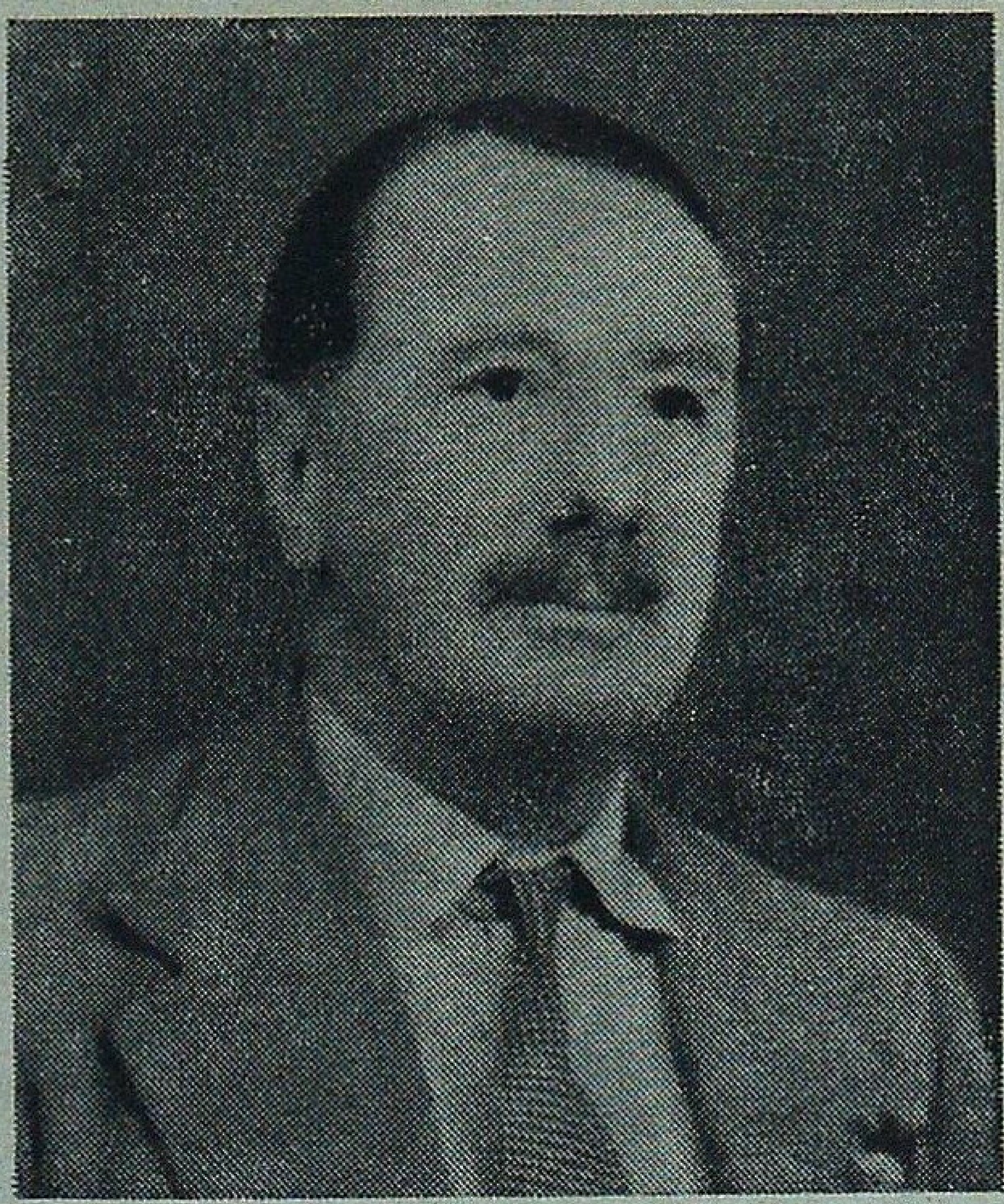
10. Shri K.C. Gayen, IFS, Divisional Forest Officer, Baikunthapur Division, as Divisional Forest Officer, Buxa Division, with effect from the date of his assuming charge *vice* Shri U. Das Gupta, W.B.S.F.S., transferred.

11. Shri A.K. Raha, IFS, now holding a junior scale post attached to East Midnapore Division, as Divisional Forest Officer, Baikunthapur Division, with effect from the date of his assuming charge *vice* Shri K.C. Gayen, IFS, transferred.

———

OBITUARY

James Stephens B.A.
(1895–1982)



James Stephens B. A. Born on 6th September 1895 Retired Conservator of Forests U.P Forest Department passed away peacefully on 26th April 1982 at his residence in Nainital which was his home for many years. He was first appointed as Assistant Conservator of Forests in 1920 and posted as Assistant Superintendent of Afforestation division under U.P. Forest Department He worked in this capacity for about a year when he joined the Imperial Forest Service in September 1921. After taking his Forestry degree from Oxford he joined his appointment as Assistant Conservator of Forests of Imperial Forest Service on 30th November 1923. He was promoted as Dy. Conservator of Forests in 1924. In the early years of his service he served in the Eastern divisions of U.P. Forest Department. He joined the Army in 1930 as a commissioned officer and remained as such for four years.

He was promoted as Conservator of Forests in 1941 and was put in charge of Utilization Circle which was responsible for War supplies during the IInd World War. It was through his ability and capability that U.P. Forest Department were able to fulfill their commitments with distinction. He was put in charge of Kumaun Circle of U.P. Forest Department in 1948 and continued in this capacity till 5th November 1952.

On the Independence of the Country he opted to serve in India and in recognition of his distinguished services he was given re–employment for 2 years after his retirement in 1950.

He was a keen shikari and had a large number of friends. He was held in high esteem amongst his colleagues and was very much respected by his subordinates all of whom mourn his loss.

C.L.B.

FRI Publications

FOREST RESEARCH INSTITUTE AND COLLEGES DEHRA DUN

Indian Forest Records

Vol. 14, No. 2—*Entomology* : Revision of termite genus Odontotermes Holmgren (Isoptera : Termitidae : Macrotermitinae) from India, by M.L. Thakur. PFRI. 23. XIV. 2.
Rs. 40.00 or £ 5.00 or $ 15.00.

Other Publications

Troup's—The Silviculture of Indian Trees, Vol. II—Dipterocarpaceae Revised and enlarged by H.B. Joshi. PFRI. 170. Rs. 41.50 or £ 4.85 or $ 14.95.

Symposium Proceedings : Silviculture, management and utilisation of Poplars, October, 15-18, 1979, Srinagar, Ed. by R.V. Singh. PFRI. 185.
Rs. 114.00 or £ 13.30 or $ 41.04

Economical timber trusses for industrial buildings, (13 to 15 Metres), by R.K. Gupta, R.K. Punhani, Sudhir Gupta and R.C. Kukreti, PFRI. 182.
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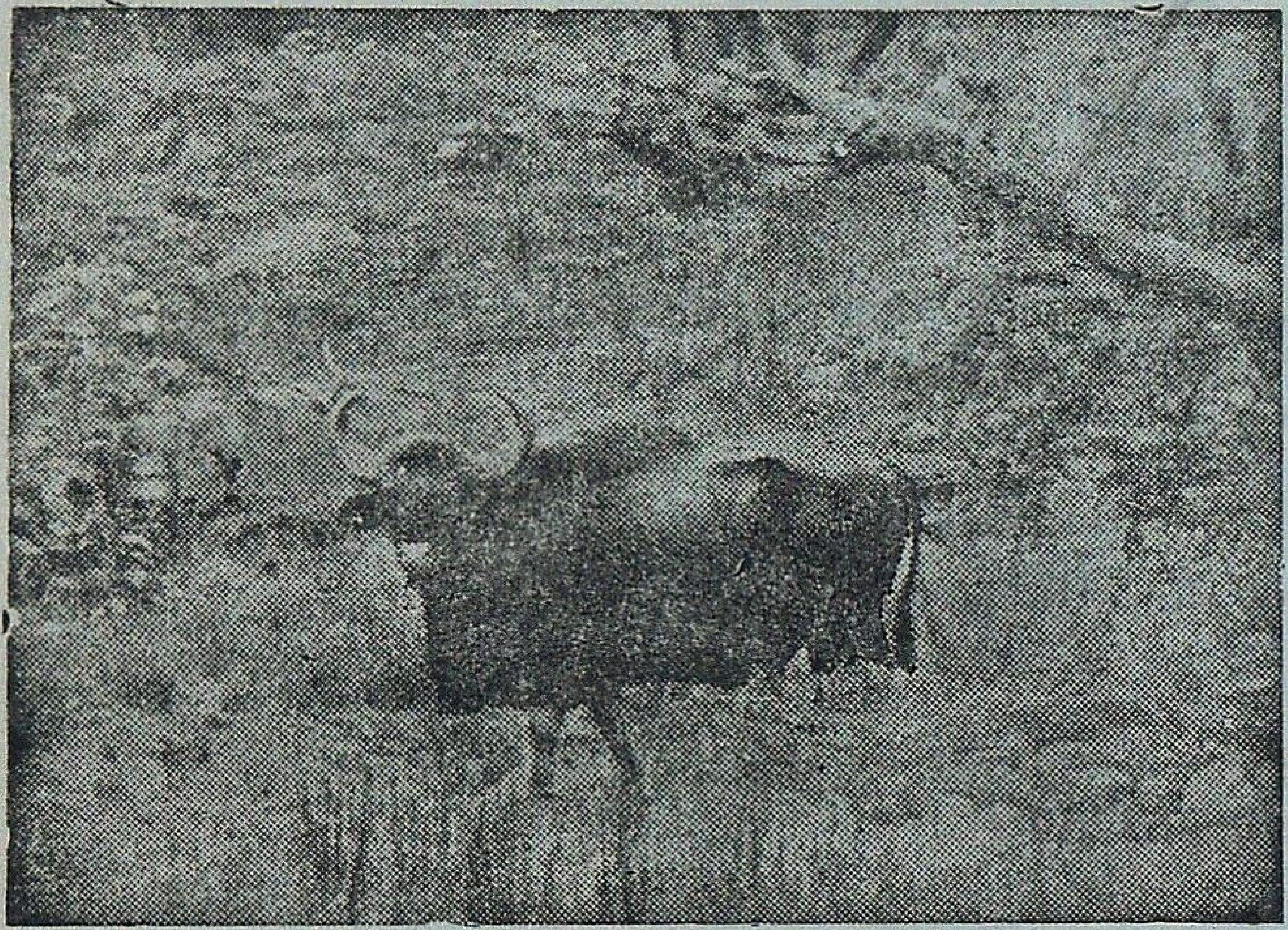

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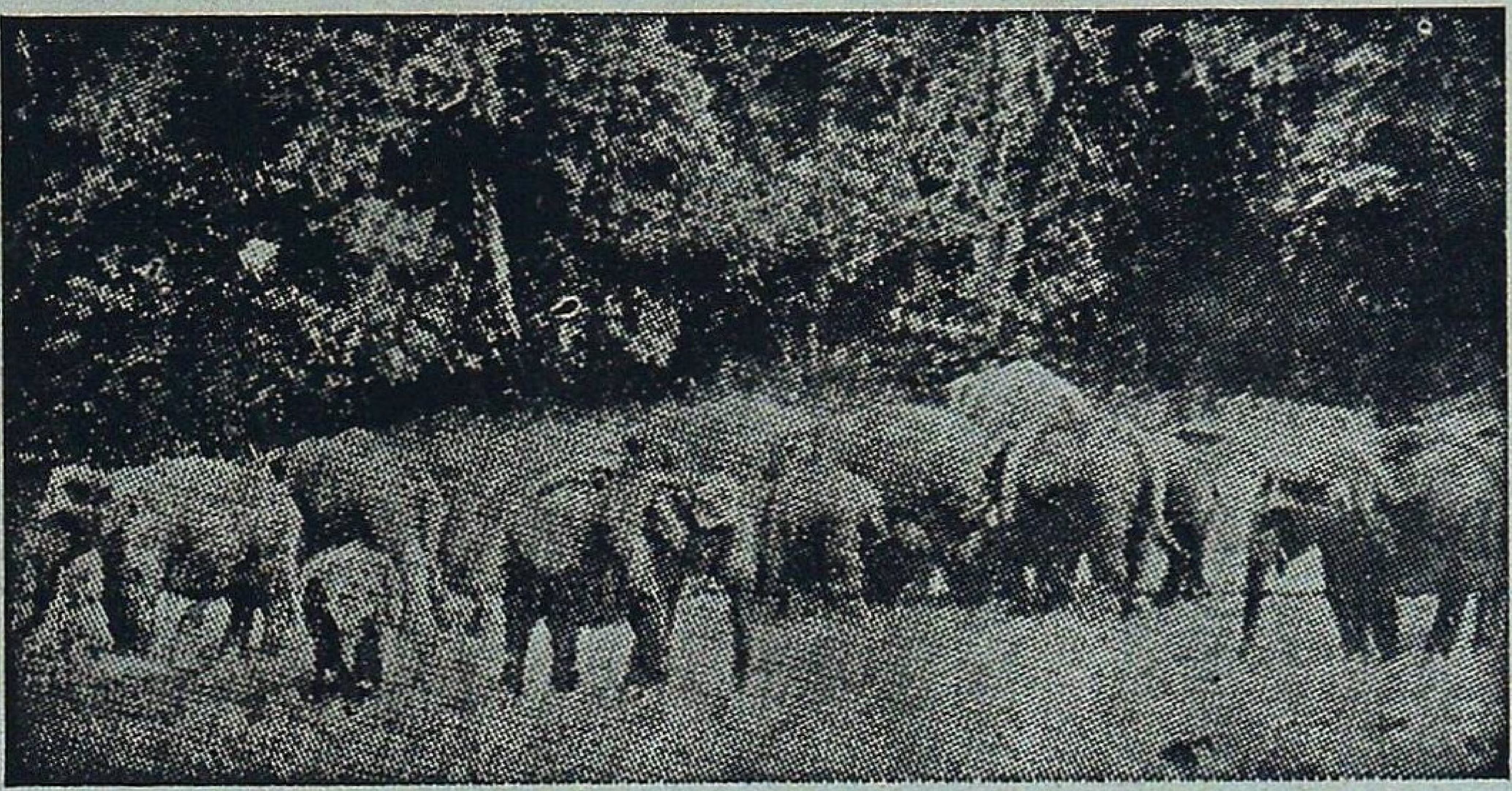

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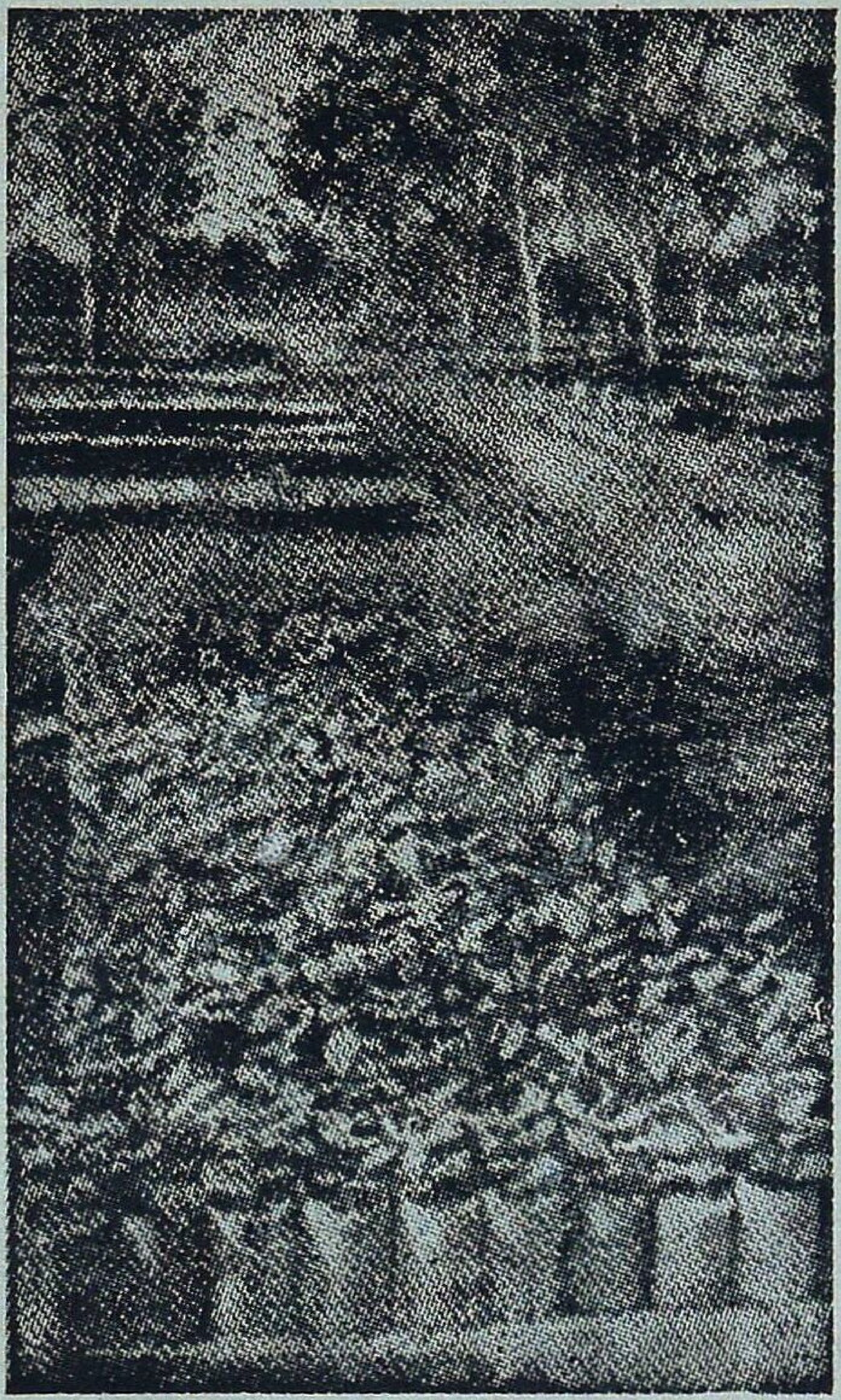

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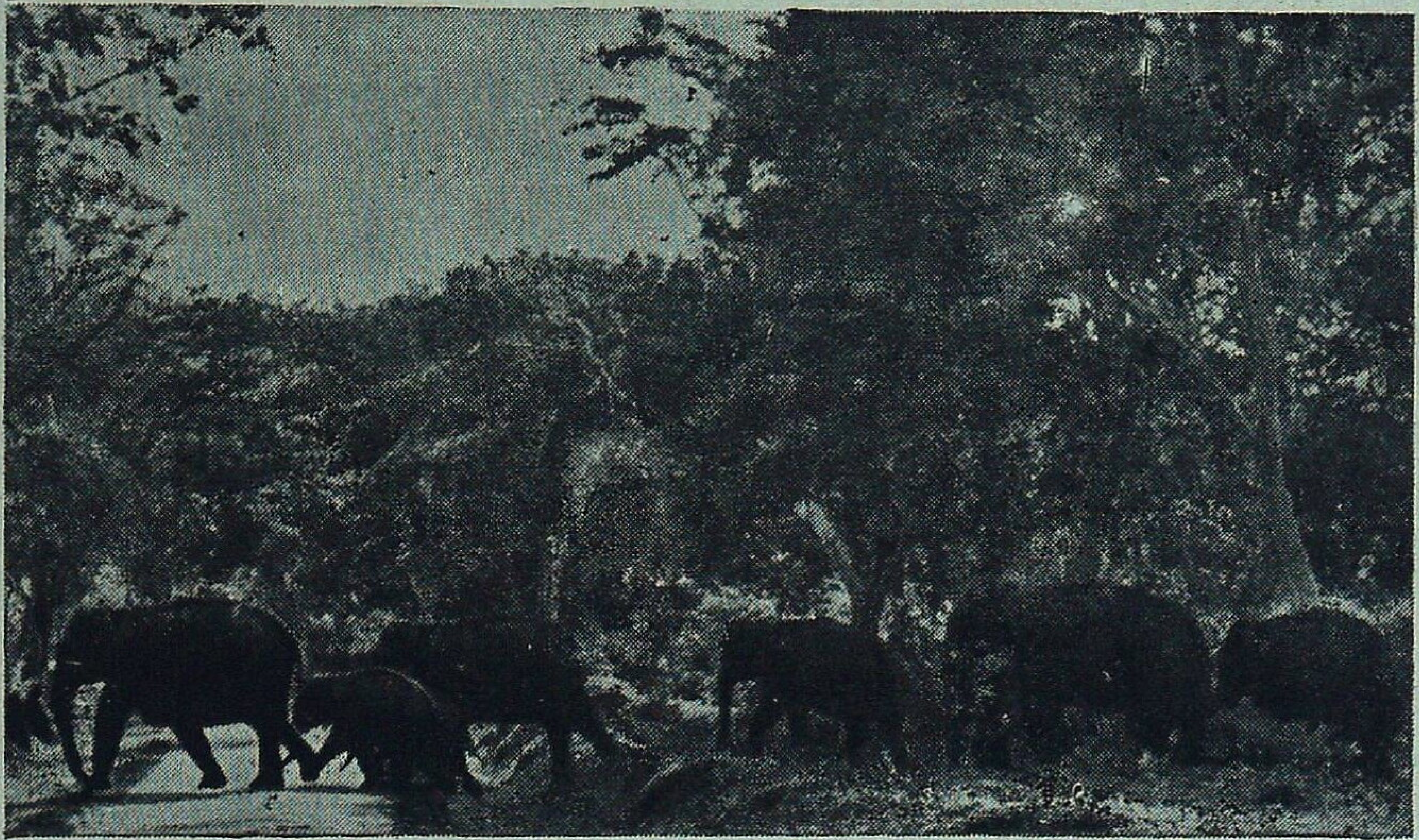

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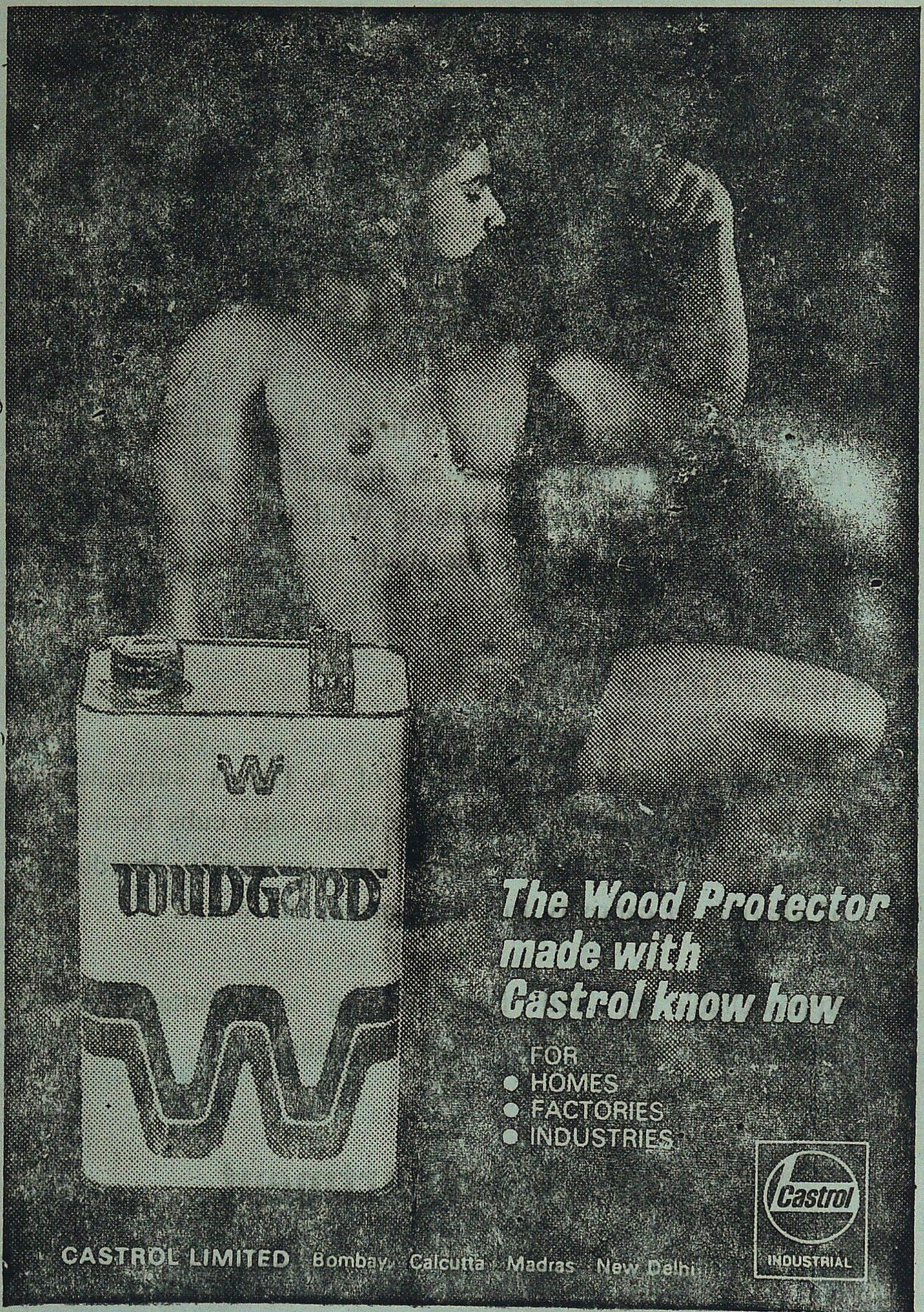
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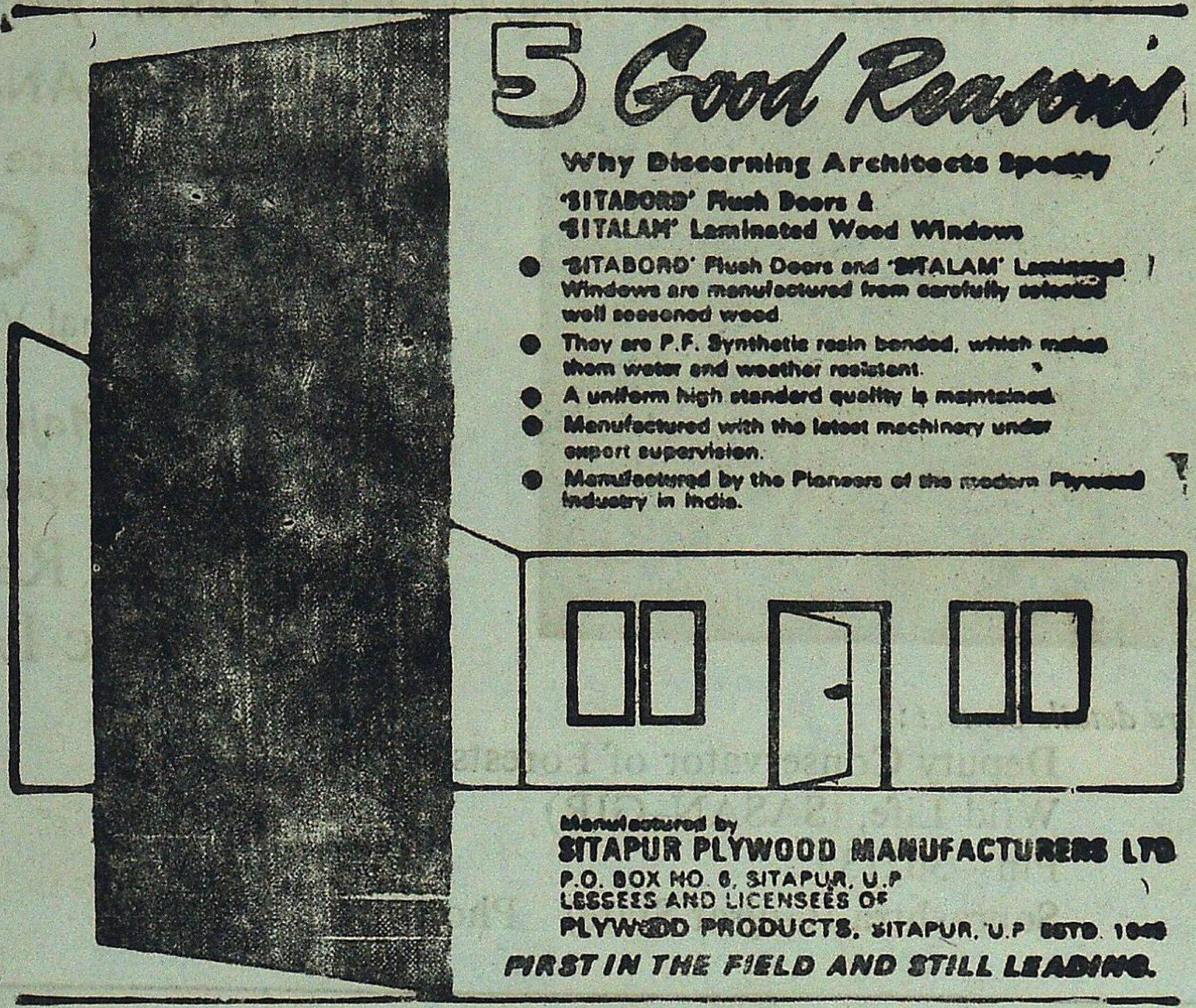

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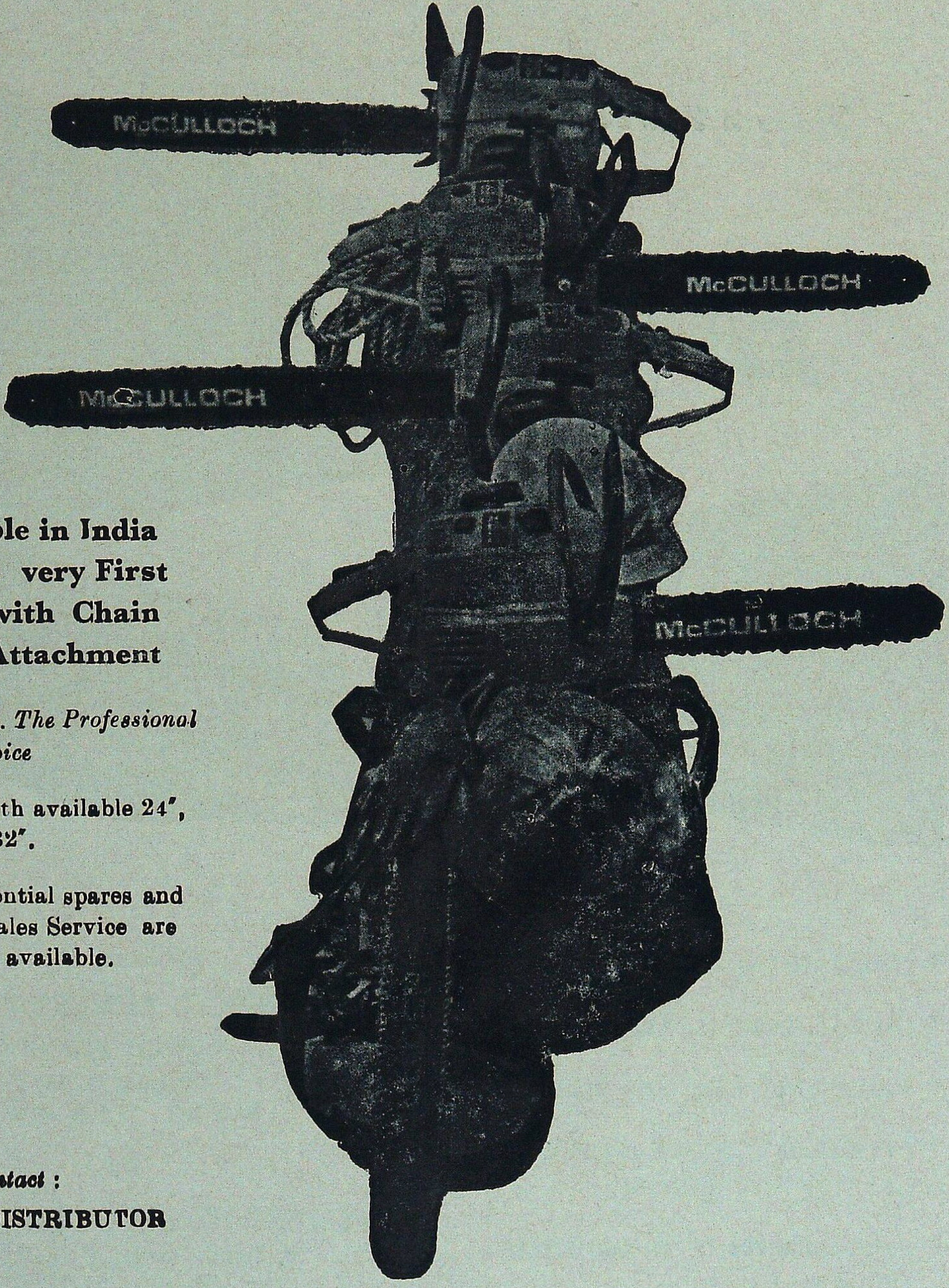

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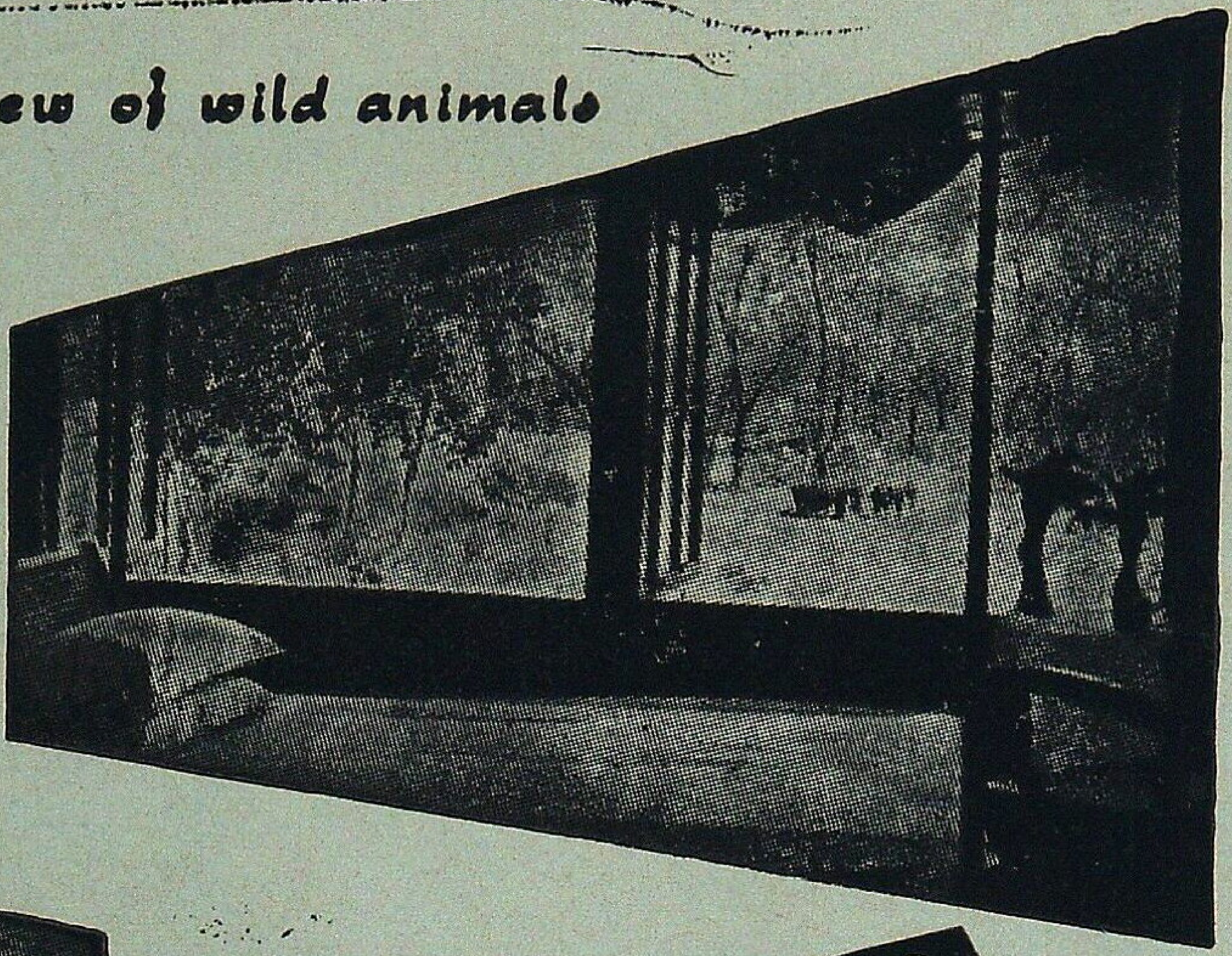

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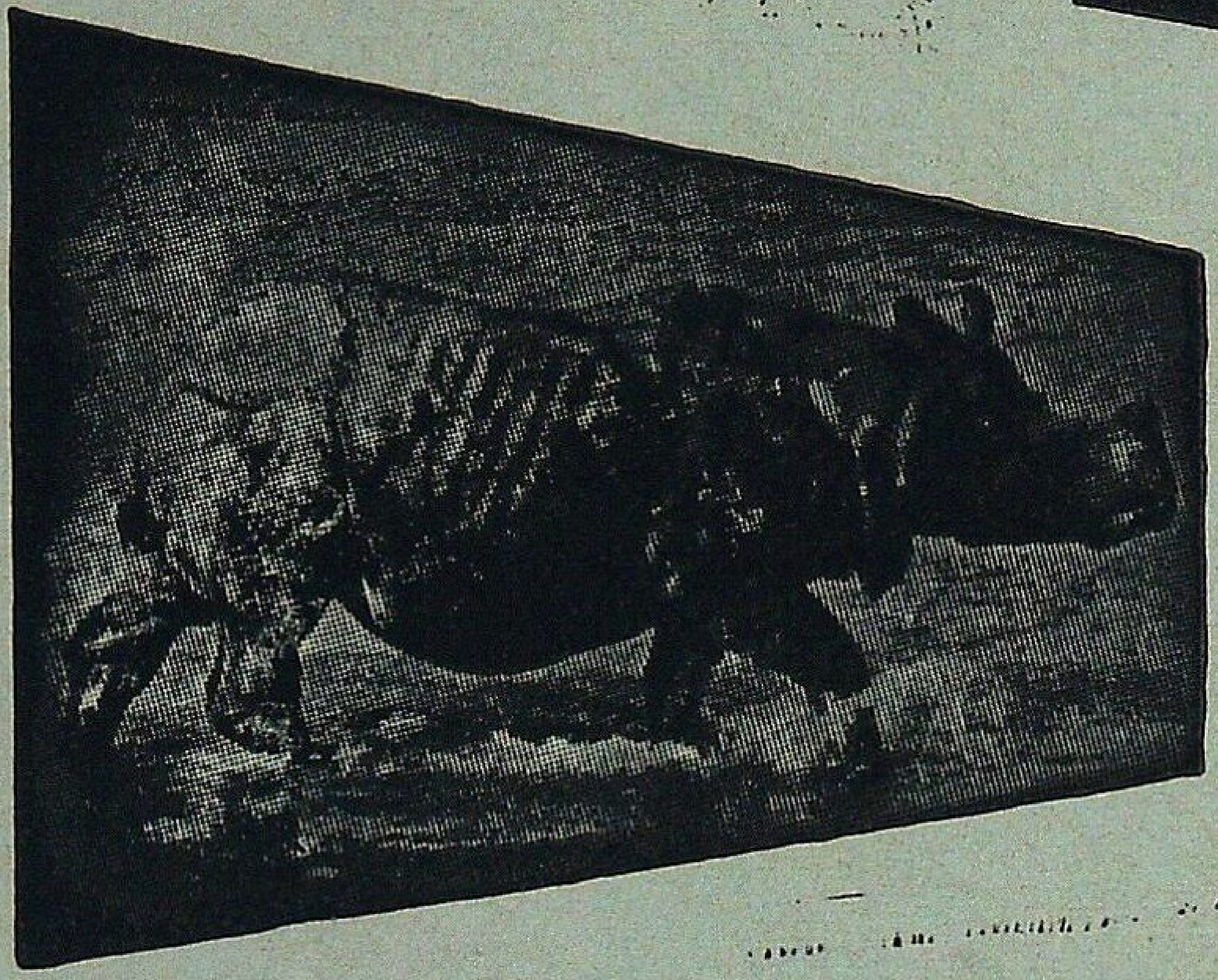

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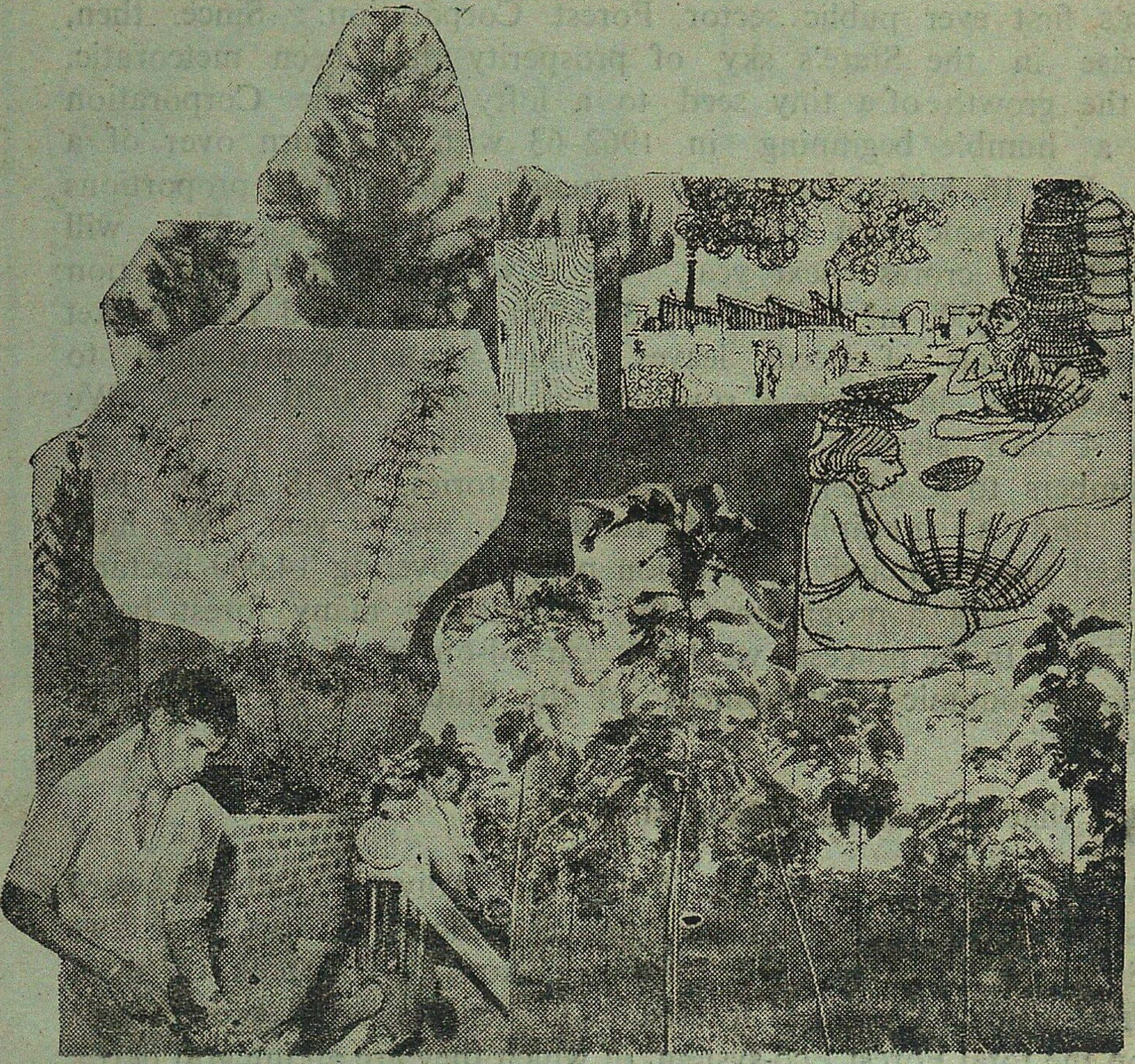

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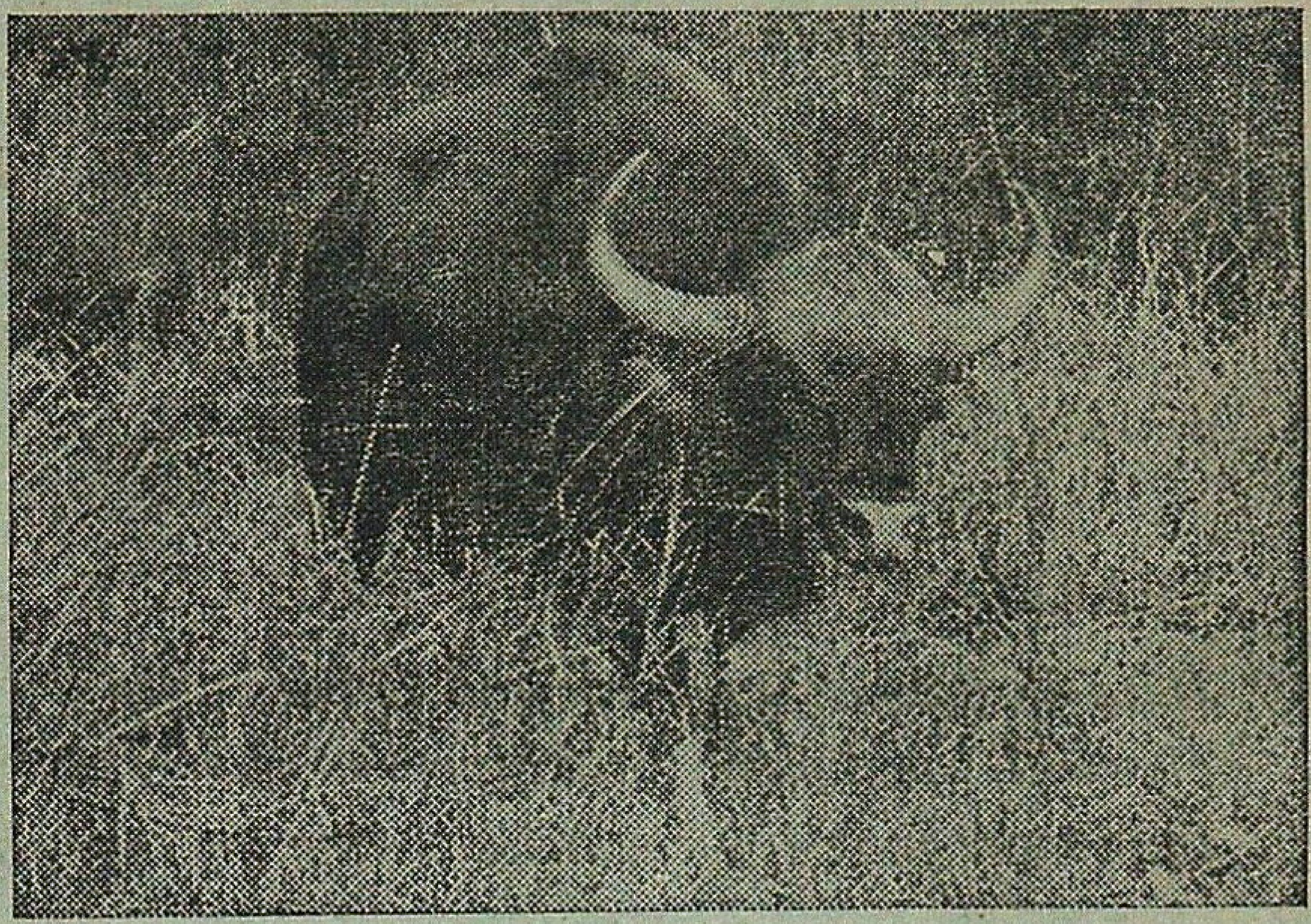

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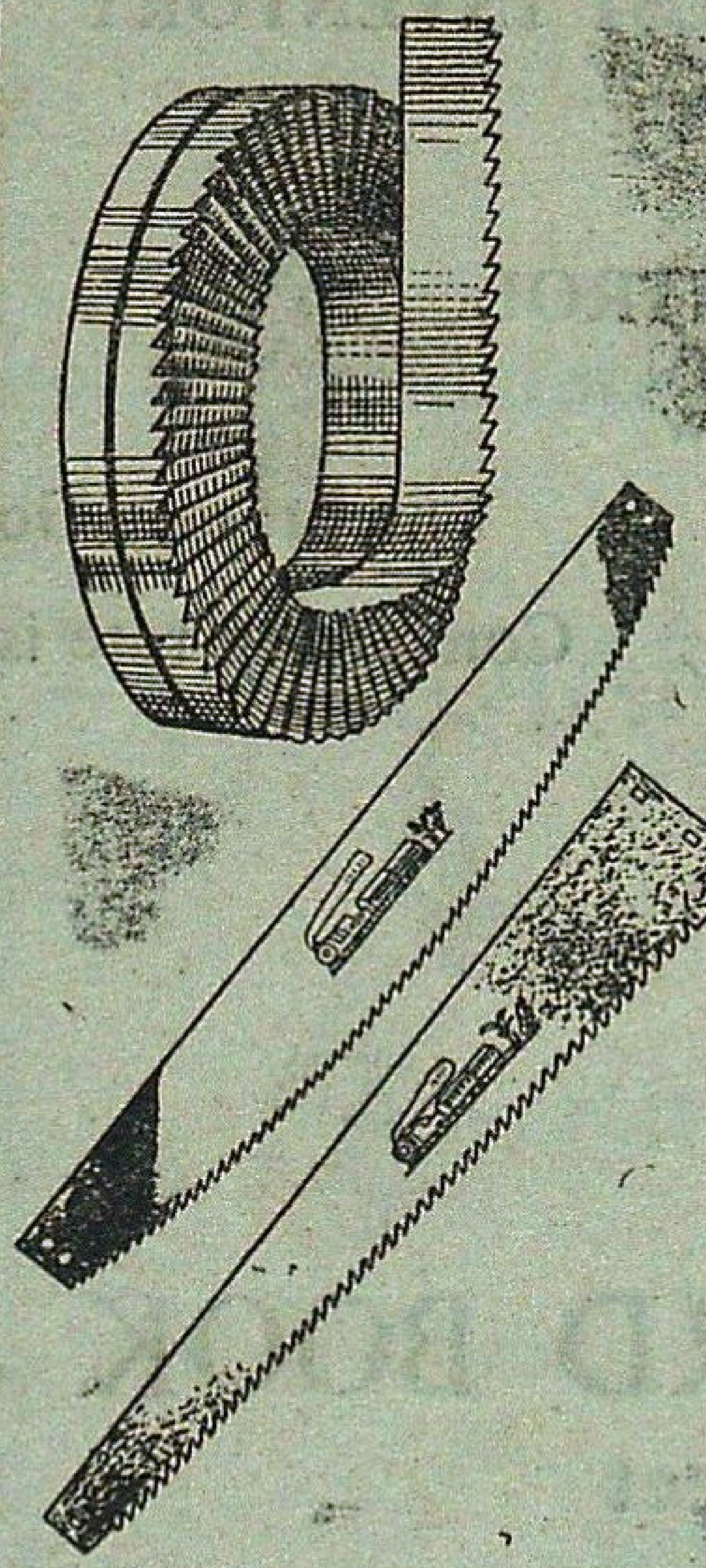

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10th November 1982 :

Forenoon : (i) Registration and inauguration.

(ii) Technical Session I—STATUS OF PINE RESEARCH TRIALS

Afternoon : (i) Visit to Koraput and Maliput Research Gardens and Ex Situ Gene Conservation areas of *Pinus oocarpa* in Devghati RF near Koraput.

(ii) Discussion on integrated forest development programme for pine plantation in Koraput.

11th November 1982 :

Forenoon : (i) Visit to Kurandhi Research Nursery and pine plantations raised by the Madhya Pradesh Forest Development Corp. Ltd. Jagdalpur.

Afternoon : (i) Technical Sessions II—SOCIAL, ECONOMIC AND ECOLOGICAL IMPACT OF PINE PLANTATIONS

Return to Koraput.

12th November 1982 :

Forenoon : (i) Visit to Anjodah Research Garden and Adapavalasa pine plantation in Andhra Pradesh.

Afternoon : (i) Technical Session III—DISEASES, INSECTS AND PROTECTION PROBLEMS OF PINE PLANTATIONS

Return to Koraput.

13th November 1982 :

Forenoon : (i) Technical Session IV—SEED AND TREE IMPROVEMENT PROGRAMME

(ii) Technical Session V—RESEARCH NEEDS AND PRIORITIES

Afternoon : (i) Recommendations of the seminar

(ii) Plenary Sessions.

The research papers on the above topics are welcome and should reach to the Coordinator, Tropical Pine Research Centres, Forest Research Institute & Colleges, Dehra Dun-248006 before 15th October 1982.

Further details can be had from any of the following officers :—

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THE

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VOLUME 108 MAY, 1982 NUMBER 5

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CONTENTS

ARTICLES

EFFECT OF ETHYLMETHANESULPHONATE IN M_1 POPULATION OF *DALBERGIA SISSOO* ROXB. M.S. Haque, M.L. Kapoor and V.K. Sharma 323

ASSESSMENT OF WEEDICIDES AND NITROGEN ON RANGE GRASSLAND PRODUCTIVITY.
R.K. Pandey, T.R. Dutta, R.P. Singh and S.D. Gupta 329

GROWTH PERFORMANCE OF *CRYPTOMERIA* JAPONICA IN HILLS OF WEST BENGAL. S.P. Singh, R.S. Sharma, M.C. Mittal and Jai Singh 336

PREHYDROLYSIS OF BAMBOO—EFFECT OF pH.
Nirankari Devi, P.P. Bhola, Man Mohan Singh and S.R.D. Guha ... 342

A STUDY OF FOLIAR AND SOIL NUTRIENT STATUS OF *SALVADORA PERSICA* LINN. IN THE THAR DESERT OF INDIA. B.M. Sharma 354

CONTROL OF POWDERY MILDEW DISEASE OF TAMARIND SEEDLINGS. A.L. Siddaramaiah and Srikant Kulkarni 361

ENVIRONMENTAL DESICCATION AND SEEDLING SURVIVAL IN *CASSIA* SPP. K.S. Daiya, D.D. Chawan and D.N. Sen 365

STORAGE STUDIES ON KATTHA. R.M. Beri and N.P. Dobhal 369

A NEW COMBINATION IN *OXYGRAPHIS* BUNGE (RANUNCULACEAE).
S.S.R. Bennet and Sumer Chandra 374

RESEARCH NOTES 375

LETTERS TO THE EDITOR 377

REVIEWS 382

OBITUARY ... ... Art Paper

GAZETTE NOTIFICATIONS xi

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